INTERNATIONAL

MARINE ENGINEERING

Published Monthly by ALDRICH PUBLISHING CO.

461 EIGHTH AVENUE, NEW YORK — 8 BOUVERIE ST., LONDON, E. C.

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Vol. XXIII — MARCH, 1918 — No. 3

Volunteer Now!

The Badge of Honor

NO service, save actual military service at the front, can be rendered to the nation that is greater than work in the shipyards. The Shipping Board has the money, the materials and the yards to carry out the gigantic shipbuilding programme to which it is pledged, but it needs men to build the ships. On this one factor alone—ships and more ships—rests the effectiveness of every other effort of the United States in the great war.

Just because you have never worked in a shipyard is no sign that you cannot become an efficient shipyard worker. Shipbuilding calls for the special application of over a score of ordinary trades. Proficiency in any one of these trades will make you a valuable asset to the Government for shipbuilding.

Volunteering for this work now does not mean that you must immediately give up your regular job and begin work at once in some distant shipbuilding city. The volunteers will be held in reserve and called for a few at a time as the need for their services develops.

Shipyard work means a generous wage and none of the hardships and privations which must be borne in military service. Volunteer now and earn the right to wear the badge of honor which is the privilege of every United States Shipyard Volunteer.

Encouragement for the Juniors

H. L. ALDRICH, associate member of the Council of the Society of Naval Architects and Marine Engineers, has offered the sum of $100 (20/16/8) as a prize for the best paper written by a junior member of the Society for its annual meeting in November, 1918. The papers must deal with some phase of shipbuilding or marine engineering, either merchant or naval, and all papers must be completed and delivered to the secretary of the Society on or before October 15, 1918.

This prize has been offered to arouse the interest of the younger members in the activities of the Society and to give them an opportunity to develop their ideas regarding the work which they have adopted as a profession. The merits of the papers will be judged by the members of the Society's Committee on Papers, who will have the right to give the whole sum donated as a prize to the author of the best paper submitted or to divide the sum into two, or even three, prizes, as may seem best, depending upon the quality of the papers submitted.

With this opportunity to gain recognition, the junior members of the Society will have a definite object in following closely the designs and details of ships and shipbuilding, as well as developing ideas of their own for improving such work.

More Meddling

IF the Shipping Board finds it necessary to invoke the aid of another branch of the Government to investigate work which is being carried out under the supervision of its subsidiary corporation, who is at fault? Is this an admission that the Emergency Fleet Corporation is unable to handle its own contracts? The Emergency Fleet Corporation placed the contracts for the construction of the three great government shipyards and is paying for the work out of public funds. If any of the contractors are at fault, isn't this a late hour to discover the difficulty?

If the investigation does nothing else, and we hardly believe it will, it may bring home to the public a better realization of the gigantic undertaking which the Government has embarked upon and of the tremendous difficulties which must be overcome to bring the work to a successful conclusion within the time allotted for it. Delays incident to severe winter weather and transportation difficulties cannot be overcome without excessive expenditures. In the present crisis the main question is, will the work be done on time?

An Heritage of the War

IN years past engineering developments in shipbuilding have, as a rule, progressed slowly, but it has remained for a world-wide war, with its waste of the world's shipping, to bring into general use some of the most radical developments in shipbuilding and propulsion. As an heritage of the war we have the change of shipbuilding to a manufacturing process, with its increased rate of production, the substitution of structural shapes and plates for shipbuilding materials, the general adoption of watertube boilers and geared turbines for cargo vessels, and the wider use of superheated steam. While necessity has led to the application of available resources to the problem of shipbuilding, nevertheless few of the innovations are likely to be immediately discarded when the period of reconstruction begins after the war, and their influence must be reckoned with in future construction. Above all, neither then nor now must the question of economy of steamship operation be ignored, for a pound of fuel saved will always mean that one pound more of cargo can be transported.

WORKERS FOR THE SHIPYARDS

Strike a Blow at the Kaiser by Helping Build a Ship

The Man of the Hour

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Enrolling Men to Build the New United States Merchant Marine

Workers for the Shipyards

The Paramount Need of the Hour—The Workers Over Here and the Boys Over There, All Dependent Upon Ship Production

BECAUSE ships are the primary factor in the winning of this war, and because the construction of these ships depends, and will always depend, upon labor, there has been created an organization of workmen known as the United States Shipyard Volunteers, enrolled under the Public Service Reserve. This organization is composed of workmen who are willing to give a good day's work for a good day's pay; workmen who are not asked to

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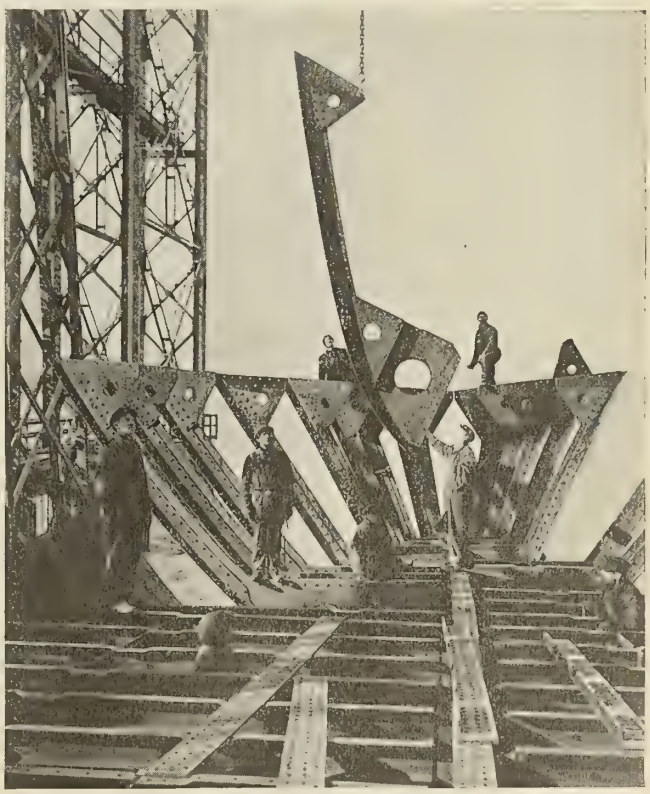
Drillers and Calkers at Work



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Ship Fitters Erecting Frames

sacrifice present positions to rush madly off to shipyards which may not be able to accommodate them for the moment, but who stand ready, when called upon, to do a particular job for a particular wage in a particular place, and who have enrolled themselves in this organization so that when needed they may be readily reached.

The Need Is Great

The need of the nation is great. The Shipping Board has the money, the housing of men is being arranged for, the yards are being completed and the materials provided. All that now is lacking is the knowledge of the need that will inspire loyal and efficient mechanics to enroll for service in the yards, not in a fashion to disrupt the business of the country through the robbing of present industries. On the other hand, it is planned to make a careful selection of men whose places can be filled without hardship, and who when called upon to give up the jobs they now hold will have waiting for them definite positions at definite wages in definite yards.

Enroll at Once

It is urged, therefore, that mechanics go at once to the nearest enrollment agent of the United States Public Service Reresrve of the Labor Department, or to the local enrollment agent of his State Council of Defense, and register themselves as willing to work in the shipyards if needed; then to retain their present positions until called personally for service.

Through the Council of National Defense an appeal has been made to governors, mayors and other prominent officials, to stimulate interest in their communities.

Edward N. Hurley, chairman of the United States Shipping Board and president of the Emergency Fleet Corporation, says:

Inspiring Words From Chairman Hurley

"If the American people could be made to realize the necessity of building ships before this war can be won, they would subordinate local needs to national necessity. They would realize that, not merely the safety of the nation depends upon the quick building of ships, but that industry itself must be disturbed and labor inconvenienced until such time as all the shipyards are working to their maximum capacity.

"The man who lays down on the job in a shipyard, reducing his output, does not give employment to another man to make up his deficiency. Instead, he throws two or three men out of work, because everything that labor turns out for exportation must wait upon the completion of the ship which is designed to carry such supplies.

"To manufacture thousands of tons of war munitions and other commodities for our army and then send them to the seaports, and not have ships to carry these supplies to France, will cause more congestion at our seaport terminals and will ultimately result in the complete closing down of many of our industries.

"The happiness of every man, woman and child in this country is involved in the shipbuilding programme. Every rivet driven in the shipyards brings us nearer to the successful termination of the war. It is a question of manpower in shipbuilding, and within sixty days we will require 250,000 skilled mechanics to help the other loyal men now in the yards to build ships so fast that supplies can be furnished to our boys in the trenches who are making the supreme sacrifice for their country."

Charles Piez, vice-president and general manager of the Emergency Fleet Corporation, says:

"We have the task of getting the men, and we have the greater task of imbuing the entire community, the entire nation, with the supreme importance of this shipbuilding programme. It does take precedence over every other single effort that we are making to win the war, and that message must be carried to every citizen.

A Duty of the Highest Patriotism

"We must have inspiration in every man who works in the shipyards, and everyone connected with them. We must have the idea that a man who does work in the shipyard is carrying with him the same sacrificial service, performing the same duty as the man at the front.

"It is not merely a job of eight hours, paying big wages. Conditions are not ideal in every community where ships are being built, although the Government is trying to make them so. The men must have that impressed upon them—they must not kick; they must not resist going. They have temporarily to bear that burden so that these ships may be gotten out, and the cause won in the earliest possible time."

In addition to the card which the volunteer fills out for the Public Service Reserve, he signs the following franked postcard, addressed to Chairman Hurley at Washington:

"Appreciating the nation's imperative need for skilled workmen to build merchant ships with which to overcome the submarine menace, I request to be enrolled as a member of the United States Shipyard Volunteers of the Public Service Reserve. I realize that the world war will be won or lost in the American shipyards. Every rivet driven is a blow at the Kaiser. Every ship turned out brings America nearer to victory.

"It is understood that if I am asked to enter shipyard employment, my compensation shall be at the rate of wage prevailing in such yards."

The button which the workmen receive after enrolling bears this inscription: "U. S. Shipyard Volunteers."

A Service Certificate to All Who Enroll

The text of the certificate which is given to him upon enrollment, or sent later, reads:

"This is to certify (name of volunteer), of (city, state), has enrolled in the United States Shipyard Volunteers of the Public Service Reserve to aid the nation in its imperative needs for merchant ships with which to overcome the submarine menace and maintain our forces at the front.

"The world war will be won or lost in the American Shipyards. Every rivet driven is a blow at the Kaiser. Every ship turned out brings America nearer to victory.

"Those who give their strength and their influence to the speedy construction of ships render service that is patriotic and highly essential to the successful termination of the war.

"Edward N. Hurley,
"Chairman, U. S. Shipping Board."

The list below shows the kind of trades most needed in shipbuilding, and a particular appeal is addressed to men in those occupations to enroll in the Reserve:

Acetylene and electrical welders; asbestos workers; blacksmiths, anglesmiths, drop-forge men, flange turners, furnace men; boiler makers, riveters, reamers; carpenters, ship carpenters, dock builders; chippers and calkers; electrical workers, electricians, wiremen, crane operators; foundry workers; laborers, all kinds; loftsmen, template makers, machinists and machine hands, all sorts, helpers; painters, plumbers and pipefitters; sheet-metal workers and coppersmiths; shipfitters; structural iron workers, riveters, erectors, bolters up; other trades, cementers, crane men.

Training Shipyard Workers at Staten Island

Shipbuilders' School Started by State and City Departments of Education—Courses Offered—How Instruction is Given

BY R. V. RICKCORD*

THE eyes of the nation are concentrated on the production of ships. The giving up of the men for fighting purposes and the realization that ships are the only form of material connection between the American army and their base at home have made the nation expect that the ships will be quickly evolved and put into service. There has been published a welter of matter purposing to give forth what should be done to meet the situation; most of this is designed for the purpose of leaving the job to the other fellow. Presumably the output of opinion is but natural, since in a great many details the country is still going through the period of vision which always precedes the actual putting of ideas into action.

The establishment of a shipbuilding school at Staten Island is the outcome of concerted efforts on the part of the University of the State of New York (State Education Department) and the city of New York Department of Education to "get something started" and then to give the benefit of their experience to shipbuilders in other parts of the State and other sections of the country.

Shipbuilders Co-Operating

Of course, the enthusiastic co-operation of the shipbuilders of the neighborhood was largely responsible for the establishment of the shipbuilding school and the degree of success it has enjoyed up to the present time. No effort was spared by them to help the State and City Education Departments. And let it be here stated as a fundamental principle connected with the establishment of a shipbuilding school by city or State authorities that unless the actual and full co-operation of the shipbuilders themselves is enlisted at the very outset and is maintained all the time the school is in operation the chances of the school's success are very small.

The general requirements for the speeding up of ship production are, first, efficient management; that is, technical expertness combined with the skillful handling of men and material. Secondly, material; this in some cases has not been easily obtainable by the shipbuilders, but is now more or less being satisfactorily distributed. Thirdly, labor.

Labor Question of Utmost Importance

It need hardly be said that of the three, the question of labor is occupying the most serious attention of the shipbuilders; the labor problem is threefold, consisting of, 1, the housing of labor; 2, the acquisition of labor; 3, the education of labor to fulfill the shipbuilders' requirements. Again, the last of these problems is twofold and embraces the training of "green" men to enter the shipyard trades and the training of men already in the yards. It is the purpose of this article to deal with the training of labor and to make known the aims and the difficulties connected with the Shipbuilding School at Staten Island. Instruction in this school is limited to and given only to those who are actual shipyard workers, and consists of auxiliary supplementary trade information which ordinarily would be given by a foreman to an apprentice or which a journeyman tradesman would have to acquire from a book or from some other source. There is, however, a possibility that an attempt will be made to train "green" men also. Those who are receiving instruction and who may receive instruction in the near future can, therefore, be divided into the following categories:

a. Fully trained tradesmen who desire more knowledge of their trade.

b. Apprentices and helpers who require immediately the information and instruction which, with the skill they acquire in the shops, will make them good tradesmen and enable them to handle more easily the next job higher up.

c. Men who are not working at and have not worked at any of the shipbuilding trades, who in consequence need full practical instruction in the shops and the supplementary information given in the schools.

Numerous applications from all over the country have come from men who desire to join classes in shipbuilding. The idea of most of these men seems to be to first take instruction at the school and then to obtain a position in the yards on the strength of the instruction so obtained. Men of this type, however, have not been encouraged by those responsible for this work, since they do not in general desire to work in the yards without training, and the school is giving only such training as will supplement the actual practical training acquired in the shops.

How Instruction Is Given

The material of instruction is presented in a short, snappy manner and is arranged so that it can be covered in twenty two-hour lessons. As the lessons are given twice a week, each course will be covered in about ten weeks. At the end of that time a crowd of fresh students will be given the course, and the students of any one course may take another. In some cases the courses are consecutive and graduation from one is a requirement for entrance into another. For example: riveting, elementary shipfitting, advanced shipfitting, elementary mold loft work, advanced mold loft work and (perhaps) hull design, follow each other in the order given.

The so-called lessons are in reality a series of conferences; the instructor is merely a leader, and the students are given the greatest possible latitude consistent with a systematic form of teaching, to bring up and discuss questions and difficulties that have arisen during the day. The association of systematic teaching with the opportunity to bring up and discuss questions that arise during the day may seem a little inconsistent; this, however, is more apparent than real.

Sample Course

It may be interesting to analyze a sample course to show what is being done with each subject. The course is not only divided up into certain exact steps, but dates are set on which the steps should be given. There are two reasons for this exactitude. The first is that the instructors are tradesmen, and no matter how much they may know about their job, they need to have every facility placed at their disposal to make up for lack of actual teaching experience. The second is that the courses are

* New York State Department of Education and Technical Advisor, Staten Island Shipbuilding School.

short and snappy and the tendency would be to leave out certain portions unless it were completely determined beforehand what should be given during a period of instruction and how it should be given.

The marine plumbers' and pipefitters' course, for instance, is divided up as follows:

Lesson No. 1.—Study of different styles of water-closets used on ships and methods of installation.

Lesson No. 2.—Study of various kinds of valves used on ships and conditions under which their use is allowable.

Lesson No. 3.—Methods of installing lead pipe work for water-closets, bath tubs and other apparatus on ships.

Lesson No. 4.—Study of bilge and ballast piping systems and methods of installing.

Lesson No. 5.—Study of sheet lead work for purposes of refrigeration.

Lesson No. 6.—Blueprint reading in connection with ship's plumbing and pipe work.

Lesson No. 7.—Study of sanitary systems, arrangements for pumping, methods of installing pipe work, valves.

Lesson No. 8.—Study of fresh-water systems, arrangements for pumping, methods of installing pipe work, valves.

Lesson No. 9.—Methods of bending pipes; lead, iron and brass.

Lesson No. 10.—Methods of wiping joints; preparation fluxes, solders.

Lesson No. 11.—Study of heating systems, methods of installing pipework, valves, study of arrangements of various circuits.

Lesson No. 12.—Methods of doing watertight work on bulkheads and decks.

Lesson No. 13.—Expanded flanges, methods of making; advantages over ordinary flange work.

Lesson No. 14.—Kinds of flanges, making of joints, study of bolts and bolt spacing.

Lesson No. 15.—Studies in estimating quantities, measuring out and assembling material from drawings and on job.

Lesson No. 16.—Method of making and installing of main steam and exhaust pipes.

Lesson No. 17.—Hand pumps used on ships, study of their uses and methods of connecting.

Lesson No. 18.—Study of hot-water systems used on ships, methods of installing.

Lesson No. 19.—Scuppers, methods of making and installing.

Lesson No. 20.—Study of oil fuel piping systems. Making of special joints, methods of installing.

Lesson No. 21.—Study of standard flanges, pipes, threads, bolts, studs and other fittings.

Lesson No. 22.—Study of Lloyd's, Veritas and American Bureau requirements.

Instructors

The matter of obtaining instructors for the courses is an exceedingly difficult problem. When the hull superintendent and the foremen of mold loft, shipfitting and riveting departments have been pressed into service there is generally little more talent that can be used for what may be called the exclusively shipyard trades. The three trades just mentioned have proved to be, both from the standpoint of the shipbuilders' requirements and also from the number of applications for instruction, the most important trades dealt with in the yards. Experience in connection with the Staten Island Shipbuilding School would indicate that shipfitting instruction has been most in demand, and after that mold loft work and riveting. The following courses are now being given and set down in their order of importance:

Shipfitting.
Mold loft work.
Riveting, chipping and calking.
Shipwright work.
Ship coppersmith.
Marine plumber and pipefitter.
Wooden shipbuilders.
Ship sheet metal workers.
Marine boiler maker.
Ship blacksmith.
Ship electrician.
Outside machinist.
Inside machinist.
Ship drafting.
Sketch making for shipyard tradesmen.
Blueprint reading for shipyard tradesmen.
General ship construction.
General ship information for clerical workers and others.

The question has been brought up from time to time as to whether it would not be advantageous to take up the training of "green" men in the schools. The chief disadvantage is that this is a much larger problem to tackle; a full complement of working tools is necessary and it is impossible to reproduce in a small compass conditions as they exist in the yard. The apprentice or helper has already had a good insight into the mechanics of shipyard work. The most logical place for the giving of practical work to beginners is in the shipyard preferably on the vessel, but if necessary a shed in some corner of the yard can be used to great advantage for the purpose. Instruction can be given by a man told off especially for the purpose of training men; that is, by a man whose job it is to produce tradesmen and not to produce ships.

Newport News Training School

The training school of the Emergency Fleet Corporation at Newport News is for the purpose of producing men who are to give this practical instruction in the yards. The School gives the prospective instructors a training which cannot quite be replaced under any other circumstances at present. The instruction given in the shipbuilding school at Staten Island is auxiliary and supplementary to the instruction given by the men turned out in the Training School at Newport News. The opinion of the writer is that, in the case of the yards who have appointed a man or men to do the work of instructing without the Newport News training, the study of teaching processes and the systematic laying out of the steps in teaching are usually notably absent.

Though the complaint is often made by the shipyard managers that the men cannot be spared from the yard to take up the six weeks' course at Newport, yet as a matter of investment it is scarcely possible to imagine one more profitable in connection with shipyard work. This will be seen if a specific instance is examined. Take the case of a riveter who goes to Newport News for training. When the man returns he can probably handle five gangs of riveters. Of course, in order to do this he must not actually start his five gangs at one time, but preferably he should start one gang and stick to that until it is going sufficiently well to be left alone; the process is repeated in a few days on a second gang. This goes on until he has five gangs going, which is as much as one man can handle and instruct efficiently. At the end of three weeks the riveter is more or less fully fledged and can be trusted alone. It will be seen that nine weeks elapse from the

time the shipyard send a man to Newport News and the time the first batch of five riveters is turned out. At the end of eleven weeks from the time the prospective instructor started the yard will have sacrificed in productive power eleven man-weeks; but by that time five gangs will have been at work for two weeks and will have done labor in the yard to the extent of ten man-weeks. After three months the gain to the shipyard is out of all proportion to the sacrifice it has been called upon to make in sending the man to Newport News.

Of course, the yards must have at their disposal material ready to be trained as outlined above. The Shipbuilding School at Staten Island has now in the neighborhood of twenty-two instructors. It will be no exaggeration to say that there has never before been so complete a collection of technical and practical shipbuilding knowledge at the disposal of shipbuilding students under one roof. This is due to the efforts of the Staten Island shipbuilders themselves; Messrs. Armstrong & Quinn, of the Downey Shipbuilding Corporation; Messrs. Godoy & Scott, of the Standard Shipbuilding Corporation; Mr. James H. Davidson, of the Staten Island Shipbuilding Company, all of whom were unsparing in their efforts to start this school with as efficient a teaching force as the Island could possibly provide.

As far as possible, the instructor takes the men from his own yards. Where there are two instructors from one yard the rule is again made to apply, and he handles his own men from that yard. The result is a very close contact between the school and the yard, an assurance of regular attendance and the giving of instruction which definitely relates to work in the yard. A difficulty occurring during the day is discussed during the evening and corrected the next day under the supervision of the instructor.

Selection of Tradesmen as Instructors

In starting a shipbuilding school, there is always a great misgiving as to how the various tradesmen will turn out as instructors. The instructors in the Staten Island Shipbuilding School have not felt any difficulty yet in giving courses as laid out by the investigators and in deeply interesting the students. This was due mostly to the efforts and careful arrangements made by Mr. Morris Siegel, who is the assistant director of evening trade schools for the city of New York Board of Education. Fortunately, Mr. Siegel had a great experience in making successful instructors from tradesmen who had never taught before. To carry out his plan it was necessary to spend a great deal of time in the yards going over the various shop processes, picking out the information that could be given in the school and placing it down on paper. The instructor is given the prospective course divided up into from fifteen to twenty-five lessons, depending on the subject. He is required to take the subject matter for each lesson and write out the actual information he intends to give for the lesson. He is also called upon to propound a sufficiently large number of questions on the lessons, to insure that he will not become spun out. Questions brought up by the students are answered by the students themselves as far as possible. Rivalry and discussions among the students are encouraged. Long-drawn-out talks on the part of the instructor are avoided whenever possible.

If the number of shipyard workers within reach of a prospective shipbuilding school is large enough, say in the neighborhood of 5,000, a man should be engaged and paid either by the yard or by the authorities who establish the shipbuilding school. His work should be to keep in touch with the instructors and students in the yard, to find and engage patriotic speakers and lecturers on suitable technical subjects, preferably to be given at school assemblies, to keep the neighborhood and yards alive to the possibilities of such a shipbuilding school, and to do all those things which necessarily need to be taken care of in connection with a new and highly technical undertaking. If the school is a comparatively small one, a suitable man from one of the yards can be appointed to give part of his time to the project; but the part-time scheme is a dangerous one and should be watched very closely.

Method of Obtaining Students

The methods of obtaining students and the means of keeping them alive to the necessity of trade education were as follows:

a. Personal request from their foreman and superintendents to attend classes in shipbuilding.

b. Patriotic talks in the yard.

c. Posters distributed over the locality and hand bills distributed throughout the yards.

d. Enrollment blanks distributed among the shipyard workers through the department heads.

e. Small slips announcing courses placed in the pay envelopes of the employees.

f. Write-ups freely published in the local newspapers.

g. Good social organization within the school itself.

The shipyard men themselves report that after the establishment of the Shipbuilding School a distinct improvement and speeding up in the yard work of the students was almost immediately noticeable, and the peculiar shipyard clannishness seemed to be somewhat on the wane.

In view of the actual benefit felt and expressed by the shipbuilders, the large attendance of the students and the willingness of the superintendents of departments and foremen to give their time for the purpose of giving instruction, the school may be said to have so far accomplished its aims. No doubt the expenses connected with the organization and running of the Shipbuilding School are somewhat heavy, but these are not higher in Staten Island than they are usually found to be in the establishment of a trade school in the city of New York. The authorities of both the city and State of New York consider themselves well repaid for their efforts in attempting to help the shipbuilders to speed up production in this time of national emergency.

Board of Trade Issues Rules for Concrete Ships.—Preliminary instructions regarding ferro-concrete ships have recently been issued to shipbuilders and ship owners by the marine department of the Board of Trade. According to these instructions, ferro-concrete vessels will be required to comply with the requirements of the merchant shipping acts. All vessels which proceed to sea, except sailing vessels and non-propelled barges under 80 tons register solely employed in the coasting trade, must be marked with a load line as required by section 438 of the Merchant Shipping acts of 1894 and section 7 of the Merchant Shipping act of 1906. The decision of the load line is regulated by the requirements of the tables of freeboard (1909) and depends upon the strength of the hull. In order that the authority to whom application will be made for assigning of a load line may be fully informed of the structural arrangements upon which the strength of the hull of the ferro-concrete ship depends, full information as to the intended arrangements must be supplied by the builder to that authority and the vessel must be built under the inspection of the authority's surveyors.

Building the Hog Island Shipyard*

Gigantic Task Undertaken by Skilled Engineering Organization—Cost of the Work—Initial Difficulties

BY GEORGE J. BALDWIN†

ABOUT the middle of last May, General Goethals took up the programme then laid down by him of utilizing existing shipyards to the utmost for the building of steel cargo vessels, and in addition constructing new yards in which 3,000,000 deadweight tons could be manufactured in eighteen months, and called upon the American International Corporation for co-operation. About a month later the President signed the Urgent Deficiency Act, which supplied the means of financing the proposed construction, and we then submitted to General Goethals a tentative plan for his acceptance, which by July was so thoroughly worked out that we were ready to begin work. Owing to conditions familiar to all it was not until September 13 that the Emergency Fleet Corporation was able to finally instruct us to proceed. This unfortunate delay is the primary cause of many of the difficulties and is the definite reason for the large cost of the work.

All of those familiar with construction tasks realize the impossibility of obtaining in a time of universal disorganization of every industry both great speed and that standard of costs attainable in normal times. We must elect between them. Our instructions urged upon us the utmost speed, which cannot be secured without great cost. We were told that speed, not cost, was the essence of the contract; that we must build ships to save the nation, and not save money to fatten our pocketbooks.

Magnitude of the Task

Let us look for a moment at the task ahead of us on September 13, 1917. The American International Shipbuilding Corporation, a subsidiary of the American International Corporation, formed for the purpose with the approval of the Shipping Board, had undertaken to construct for Emergency Fleet Corporation fifty 11½-knot, 7,500-ton cargo vessels, each 400 feet long, and upon October 23 was awarded a second contract to build seventy 15-knot, 8,000-ton combined transport and freight vessels, each 450 feet long; also it was to build a shipyard suitable for the construction of not less than two hundred vessels in which the building of ships might continue as long as necessary on a scale and at a speed never before attempted.

We had already considered the designs for the 7,500-ton vessel prepared by Mr. Thomas E. Ferris, naval architect of the Shipping Board, but all of the detailed work ordinarily requiring months was ahead of us. No design had yet been worked out for the new 8,000-ton type. We had provisionally arranged methods of securing all of our materials, machinery and supplies. We had secured an option upon the best and apparently only adequate site on the Atlantic Coast for a shipyard of this magnitude adjacent to one of the large industrial cities, but beyond this little more could be done until the order was given to go ahead.

General Goethals' original plan was the construction of a yard with 50 shipways, upon which 200 vessels all exactly alike should be constructed. The task has been immensely complicated by the necessity of working upon its construction during the most severe winter known for many years, instead of during the fine weather of the autumn, as we had originally planned. After starting work upon the yard, the task was still further complicated and increased in magnitude by the addition of a second type of vessel of 8,000 tons, thus requiring the doubling of many facilities.

Size of Hog Island Plant

The Hog Island yard contains about 900 acres, and will have 50 shipways in five groups of 10 each, a fitting-out basin containing 7 piers each 1,000 feet long, with a capacity of four ships per pier. There is not in Philadelphia to-day a single pier of this length, and not many in the country. The classification, storage, holding yards and distributing tracks for material entering into the construction of the 120 ships require 75 miles of standard-gage railway track. The covered buildings, such as plate and angle shops, blacksmith shops, machine shops, etc., with office buildings, mess halls, fire stations, police headquarters, living quarters, etc., will include more than 25 acres under roof; 75,000,000 feet of lumber will be used, about half a million tons of steel and nearly 30,000 men will be required as a maximum—a larger force than has ever been organized for shipbuilding in any previous yard.

It is impossible to estimate the cost of such a proposition conducted under its many inherent difficulties, but we believe that the original estimate submitted last June of approximately $20,000,000 (£4,100,000) for the yard, which was concurred in by the best judgment of the officers of the Emergency Fleet Corporation and the engineers of the American International Shipbuilding Corporation, would have been sufficient if the work could have been commenced at that time. Difficulties in transportation and labor which could not be foreseen and the all-important fact that postponement in starting the work made it necessary to perform the heavy part of it during most severe winter weather will very materially increase the cost of the work.

Estimated Cost

The total estimated cost of the first fifty 7,500-ton boats at $1,100,000 (£226,000) each is $55,000,000 (£11,300,000). The fee for constructing each boat is $55,000 (£11,300), with certain penalties which may reduce it to $41,000 (£8,400), one-half payable when each boat is one-half completed, and the remainder when it is accepted by the Government. The second lot of seventy 8,000-ton boats at an estimated cost of $1,650,000 (£338,000) each totals $115,500,000 (£23,660,000). The fee per boat is $82,500 (£16,900), perhaps reduced by penalties to $65,000 (£13,300). The aggregate estimate for the boats and yard is $200,500,000 (£41,000,000), a large part of which will be expended in Philadelphia for labor, equipment and supplies, in addition to a probable expenditure for necessary housing for laborers of perhaps $10,000,000 (£2,050,000), or $12,000,000 (£2,460,000). This represents the largest development, the greatest effort and the quickest expenditure of that amount of money ever experienced by Philadelphia.

* Extracts from an address delivered before the Philadelphia Chamber of Commerce on February 7.

† Vice-President American International Corporation and chairman of Board of American International Shipbuilding Corporation.

We have estimated that we can deliver twenty-five of these boats in 13½ months from September 13, 1917; 25 more in 15 months; another 25 in 18½ months; a fourth 25 in 20 months, and the last 20 in 22 months from this contract date, which will require an average delivery of one ship every two days during the eight and a half months specified.

The total tonnage so far ordered is 935,000 deadweight tons, capable when constructed of earning at rates fixed and approved by the Shipping Board Chartering Committee for steamers of 6,000 tons or greater deadweight capacity aproximately $10 (2/1/8) per ton per month, or, more exactly, $307,186 (£63,000) per day, or $9,215,593 (£1,900,000) per month. You can therefore readily see the importance of saving time as a commercial proposition, as if we can expedite time of construction by one month we save over $9,000,000 (£1,850,000), for each month's operation of the fleet, which is only the commercial value of these vessels. What they are worth for purposes of winning the war is beyond computation.

Fees

For doing this work we are to receive a fixed fee of approximately $6,600,000 (£1,350,000), equivalent to 3.3 percent upon the total monies expended. From this compensation must be deducted excess profits tax, which will probably reduce the final net compensation one-half. The salaries of executive officers, a large staff of highly paid men, and certain other expenses must also be paid by the company from the fee which it will receive. While not figured on a percentage basis yet, if so calculated the net fee to the corporation will work out to something like 1½ percent, if indeed it eventually averages that much. There are no indirect profits of any kind.

Much of the work, due to its urgency and the need for speed, must be handled by sub-contracts, which have been given to the most experienced and reliable contractors having organizations and equipment immediately ready. All sub-contracts are on a cost-plus-fixed-fee basis, the fee being calculated at 5 percent of the estimated cost of the work done, with certain allowances for depreciation of the contractor's equipment. These contracts, as part of the yard work, bring no profit of any kind to the corporation.

All wages and salaries are fixed by the Government. Materials used are purchased either by the corporation, as agent of Emergency Fleet Corporation, or, as in the case of lumber, piling, crossties, etc., directly by the Government Corporation. Every order given is approved in advance as to price and other detail by Emergency Fleet Corporation's representatives.

We were instructed to build fifty shipways, together with all the necessary shops and appurtenances, so that not less than 200 vessels could be properly built in the yard. All of the plans have either been furnished or approved by the Emergency Fleet Corporation. The vessels are being constructed under its specifications, and it has full control over all orders and instructions issued by us concerning the purchase of material, the progress of the work, the employment of labor and the rates paid. It furnishes all of the money necessary excepting the cost of the real estate, which is owned by our corporation. Finally, if at any time the work is not being done to its entire satisfaction, it has the right to terminate the agreement immediately, and at the end of the contract to purchase the land at its purchase cost by our corporation.

New Methods of Shipbuilding Necessary

The problem was to produce the greatest number of first-class steel ships in the shortest time. They must be cargo ships of ample carrying capacity and satisfactory speed. They could not be built in any of the already overburdened existing yards. Entirely new methods of shipbuilding must be employed never before used, but none of these things must be experimental. The vessels must be the result in every particular of well-tried methods which our machine shops, factories and shipyards had experimented with and approved in long practice. In answer to this problem three entirely new ideas stood out:

1st. A design so radically simplified and standardized that every succeeding vessel would be an exact reproduction of the first, identical in every detail, thus eliminating every possible variation in size and shape of material.

2d. The plan required the mobilization throughout the entire country of the largest proportion possible of all resources germane to shipbuilding and the adaptation of these resources to the new purpose. This included first and foremost the bridge and structural steel industries, then the builders of engines and boilers, the forges and machine shops and factories capable of producing any pieces of equipment entering into a ship, from a propeller shaft to a sextant. This meant a mobilization of the men, the plants and the engineers of more than 1,000 high-class manufacturing organizations throughout the United States. New organizations could not be thrown together, nor new plants built, to do this work; nor could it all be brought to the shipyard, as the output must be secured from thoroughly organized shops of long experience.

3rd. The reproduction of vessels in large numbers, every one of exactly the same construction, permitted the use of the factory methods in which America is pre-eminent. The new shipyard was to become the assembling floor of a colossal ship factory, whose machinery was made up of all the inter-related wheels of American industry, whose employees were a large part of the entire body of American labor, and whose conveyor belts were the American railways.

This solution, both in method and in magnitude, was a new departure in shipbuilding. Standardization had been attained to a slight extent in England, but on nothing like the scale demanded by the present programme. It required the consolidated and co-ordinated effort of scores of the largest, strongest and most efficient corporations in the United States and could not be accomplished in any other way. Ten or fifteen years ago, before our industries had achieved their present prominence and size, the task would have been an impossibility. To-day we are performing it.

What the "Fabricated" Ship Is

The "fabricated" idea simply means that you have a "manufactured" ship instead of a "made-to-order" ship, just as we have "manufactured" automobiles instead of "made-to-order" ones.

All non-essentials have been suppressed. Curvature of plates, especially those requiring multiple bending, were as far as possible eliminated. Ordinary structural steel beams were substituted for special ship shapes. No camber of the decks, but flat, like those of a battleship; no shear, but a straight deck line from bow to stern, perpendicular sides and a flat bottom; a strictly rectangular midships section, only curving on the bilges; a design of boat carefully combining the best ship and bridge builders' practice with that of our most efficient manufacturers. Maximum cargo space was adjusted to maximum safety, utilizing a multiplicity of bulkheads, which have saved more than one torpedoed oil tanker from going to the bottom. This designing has been so accurately and carefully done that the model tested in the Government testing

tank shows a speed as great and requires as little power as the average vessel turned out in our best shipyard practice.

If fabricated shipbuilding is a success, and there is no reason to suppose that it will not be, the methods of building cargo ships may be revolutionized. This is an ambition which any community would be proud to realize. Achieved by a city already noted for its great industrial development, it will be something to marvel at, but this will not come without effort, sacrifice and earnest civic endeavor.

In the conventional shipyard each vessel is designed and the specifications prepared in accordance with the client's desires. The steel and iron required in the form of plates, shapes, angles, etc., and all other materials are delivered from the mills to the shipyard where the plates are shaped and punched, the frames bent, punched and beveled, the riveting done, the stern posts and connecting rods, etc., forged, the pumps, boilers and engines built; in fact, every component part of the vessel worked out to a special design, so that each boat stands unique as an individual piece of workmanship, made such by a trained force of skilled shipbuilders.

America had standardized the construction of machine tools, making them better and cheaper than any other nation. It had standardized its agricultural machinery and supplied Europe, South America, Asia and Africa. It is pre-eminent among nations in manufacturing standardized, simplified machinery in wholesale quantities, and in place of the "made-to-order" individual ship we have simply substituted the manufacture of ships in wholesale quantities, something which no private concern has hitherto dared to experiment with on account of the vast amount of money required and the difficulty of selling or utilizing the product. No other opportunity has ever arisen under which such construction could be undertaken before the present emergency forced it upon us.

Initial Difficulties

Everyone who has followed the work in the International Shipyard is fully conversant with the tremendous physical difficulties encountered in converting an unimproved tract of shore property into a shipyard with the utmost speed. The nearest approach by trolley or railroad was a mile and a half distant. There were no connecting freight nor passenger lines, no water and no source of power supply. By the middle of January facilities, not the best in the world, but still unusual as transportation development goes, were at hand, sufficient to carry 22,000 men into and out of the yard. Roadways of standard construction have been built into and through the island, housing facilities for many thousand men completed, administration, engineering and other necessary buildings completed by the acre, freight lines built into the yard and tracks laid sufficient to permit the unloading of 250 freight cars per diem; a water system has been installed and electric power introduced. The essential features of the shipyard, the 50 shipways along the water front, have reached an advanced stage of completion. All this has been done in the face of the greatest railroad congestion ever known and during the most severe winter ever experienced, in Philadelphia, a winter in which for more than five weeks the thermometer has hardly gone above the freezing point.

If anyone should turn to his neighbor and ask him whether or not in four months it is possible to create a satisfactory organization embracing 22,000 people, the answer unquestionably will be no. It would be absurd to say that our organization of an equal number created in that space of time is fully satisfactory. There are but few organizations of this size in the country, all of which have been the result of many years of growth and careful preparation in normal times of peace. Yet, in spite of all that, and in spite of the natural difficulties of the site itself, and in face of the severe winter, one of unparalleled railroad congestion, we are to-day up to our schedule and the yard has reached a point of completion beyond which no one could humanly expect a job of this kind to have advanced.

Success Confidently Predicted

Moreover, I am able to-day to say that, if we can from now on secure a steady flow of material to the yard and if we are permitted to continue with the full programme of 50 ways after completing the 32 which we are now pressing forward most quickly, we expect to deliver the ships contracted for at the time originally expected. Furthermore, as nearly as we can now estimate, despite the increase in expenses and despite the delay in time caused by circumstances uncontrollable by anybody, the increased final cost of the 120 ships to be built by us as agent for the Government will probably not exceed 10 percent of their total cost, even charging the entire cost of the yard solely to these vessels.

Who are the people to whom this great work has been confided? Is it within their power to accomplish it?

What the American International Corporation Has Accomplished

The American International Corporation has been formed for the purpose of promoting international trade in American bottoms constructed by American shipbuilders and carrying the freight of American merchants to all quarters of the world. It was equipped to undertake great engineering tasks in foreign countries and to finance them with American capital. In carrying out these purposes it had rescued from destruction the well-known Pacific Mail Steamship Company, now successfully operating the only regular line of importance carrying the American flag between this country and the Orient. It had become interested in other ocean transportation lines and had purchased one of the oldest and best equipped shipbuilding yards in the country, whose force of naval architects, engineers and efficient shipbuilders was second to none, the New York Shipbuilding Corporation of Camden, which, in addition to carrying on its own great undertakings, has supplied nearly 100 men for Government service. We were therefore fully equipped to apply the very best American shipbuilding intelligence and experience to the new task.

Closely allied with the American International Corporation was the engineering firm of Stone & Webster, of Boston (builders of the great Keokuk dam and many other important works), which came to the job fresh from a most economical and quick construction of one of the great military cantonments. Although it had already supplied more than 800 men for national service, it still had an equal number of competent engineers and construction men ready for the engineering and construction end of the work.

A full knowledge of these facts caused General Goethals to select our corporation for this work and induced Mr. Hurley and Admiral Capps to confirm his judgment. There seemed to be no better combination of effective, organized power ready at hand and no time to build up new organizations. Those which had been perfected during long years of effort must necessarily be the ones to use if quick results were desired.

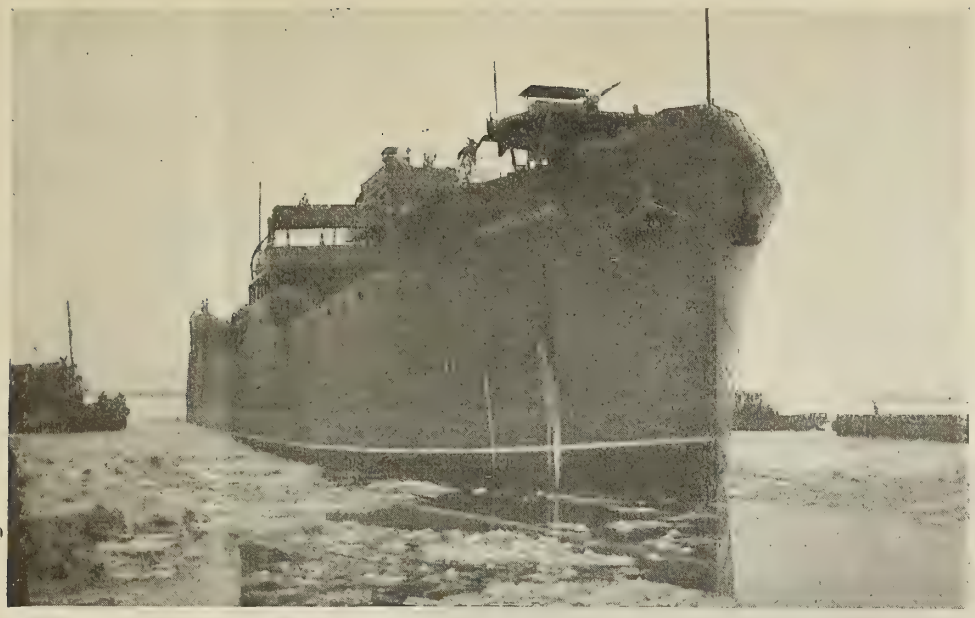


Fig. 1.—First Sun Oil Tanker Backing Out of Fitting Out Berth for Trial Trip.

Fig. 2.—S. S. *Chester Sun*, first 10,000-ton Oil Tanker Built by the Sun Shipbuilding Company.

Oil Tanker of 10,000 Tons Deadweight Adopted as Standard by Shipping Board

Description of Oil Tank Steamer Designed by Sun Shipbuilding Company and Adopted by Shipping Board as Standard

As a standard for the construction of oil tank steamships, the U. S. Shipping Board has adopted the plans and specifications of the 10,000-ton oil tanker designed by the Sun Shipbuilding Company, Chester, Pa. The Sun company has given the Shipping Board permission not only to adopt this vessel as a standard for future oil tank construction for the Government, but also to have vessels built in accordance with these designs at other shipyards without compensation to the Sun Shipbuilding Company.

The general design of the vessel was worked out by Mr. Albert Ed. Saunders, naval architect of the Sun Shipbuilding Company, while the design of the propelling machinery was in charge of Mr. A. A. Howitz, chief engineer of the Sun Shipbuilding Company.

The principal dimensions of the vessel are as follows:

Length overall	444 feet
Length between perpendiculars	430 feet
Beam, molded	59 feet
Depth, molded	33 feet 3 inches
Load draft, about	25 feet 6 inches
Total deadweight carrying capacity at above draft,	10,300 tons
Designed speed	10½ knots

General Arrangement

As can be seen from the general plans reproduced herewith, the vessel has a straight stem and semi-elliptical stern with the machinery aft. The hull is built on the Isherwood system of longitudinal framing and has two continuous steel decks from stem to stern, together with raised poop, bridge and forecastle decks of steel.

The hold is divided by transverse and centerline oiltight bulkheads forming nine main cargo oil tanks on each side of the centerline. A cross bunker is forward of the machinery space aft and a water ballast tank is fitted forward.

A continuous expansion trunk extends between the upper and main decks from the forward boiler room bulkhead to the forward end of the main cargo tanks. Sum-

mer tanks are fitted in the wing 'tween decks, five on each side over the main cargo tanks.

Dry cargo space is provided in the forward hold and 'tween decks. The pump room for the cargo is amidships, while the bilge pumps are located in a steel inclosure in the forward hold. Reserve feed water and ballast are carried in a double bottom extending only under the machinery space.

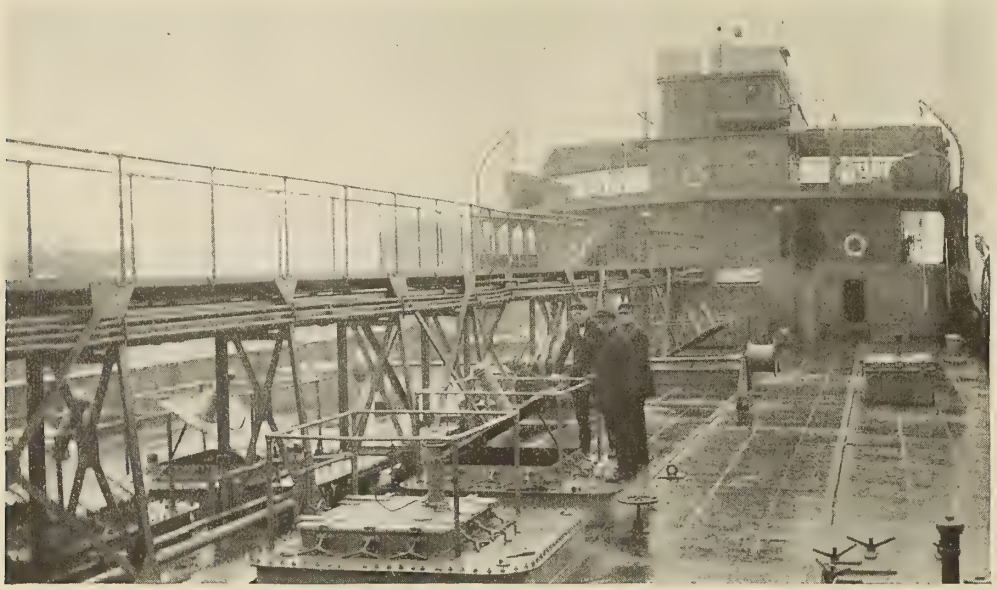


Fig. 3.—Upper Deck, Showing Runway and Hatches

ACCOMMODATIONS

Houses under the forecastle are arranged for the boatswain's stores, carpenter shop, paint, lamp room, etc. The midship deckhouses are arranged for the accommodation of the captain, officers and saloon, with wooden chart and wheel house superposed. Steel houses aft on the poop deck abreast the engine casings are used for the engineers' quarters, mess room, pantry, etc. The galley is on the poop deck abaft the engine hatch. The crew and petty officers, with their messrooms, etc., are located on the poop deck at the after end abreast of the engine hatch, while the cold storage equipment is on the main deck abaft the engine room.

Oiltight hatches to each oiltight compartment are fitted on the upper deck, while cargo hatches are provided for the forward hold and to the cross bunker and poop 'tween decks.

The vessel is rigged with two hinged steel derrick masts and one wireless mast. Two 5-ton booms are provided on the foremast and two 5-ton booms on the mainmast. Hand and steam steering gear are provided in the aft 'tween decks, and a steam windlass forward on the forecastle deck. Deck winches with extended warping ends are

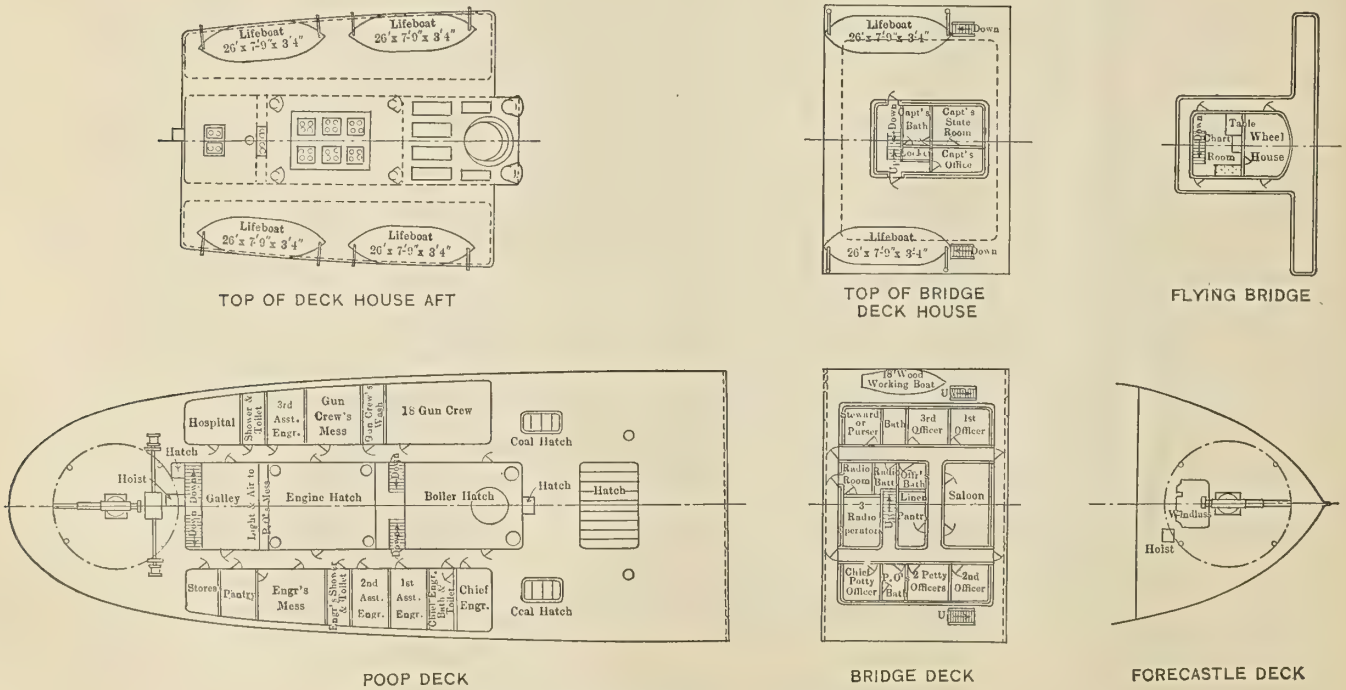
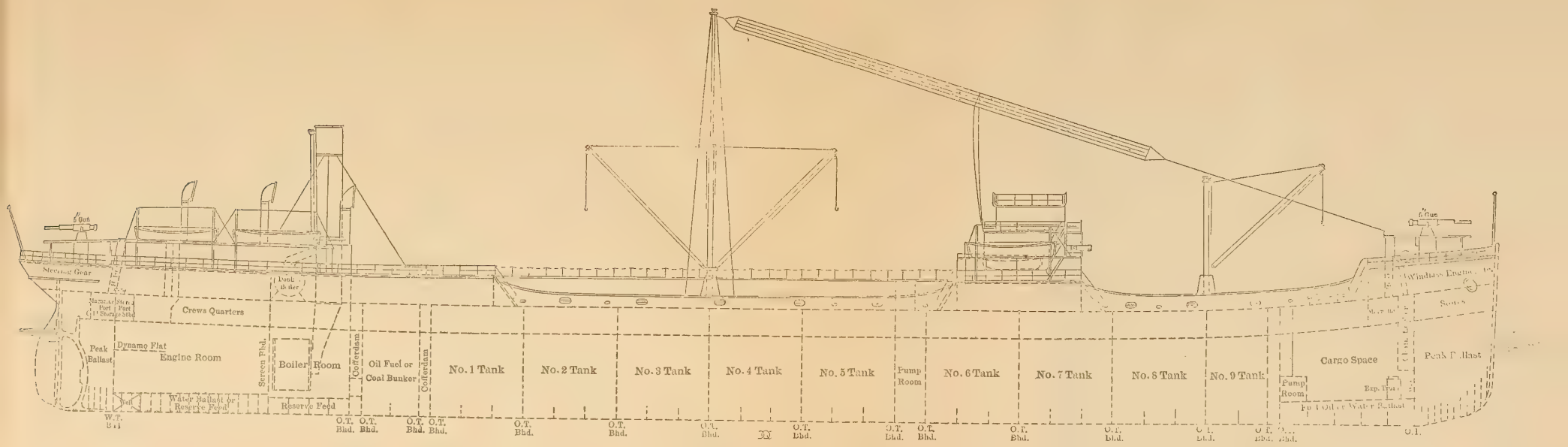


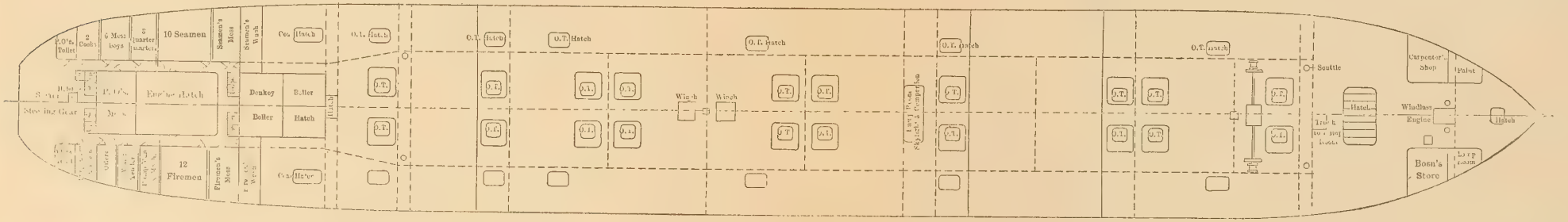
Fig. 4.—Plan of Poop, Bridge and Forecastle Decks

Steerin

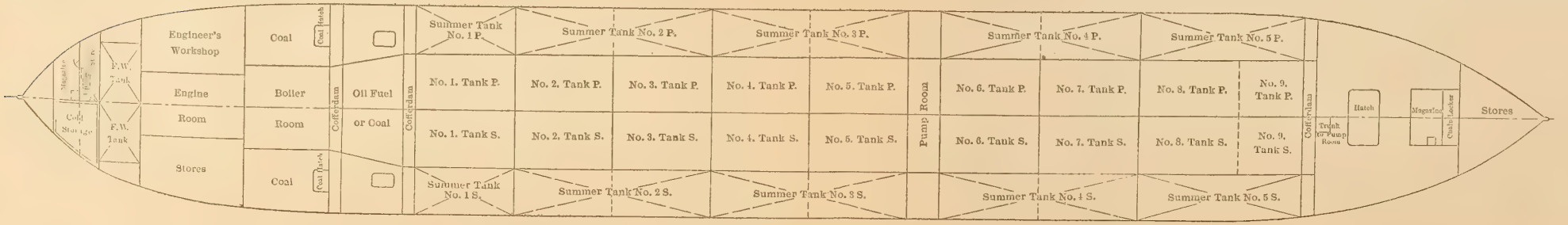
OIL TANKER OF 10,000 TONS DEADWEIGHT CARRYING CAPACITY

Designed by Sun Shipbuilding Company, Chester, Pa.





UPPER DECK



MAIN DECK

Fig. 5.—Profile and Deck Plans, Showing General Arrangement

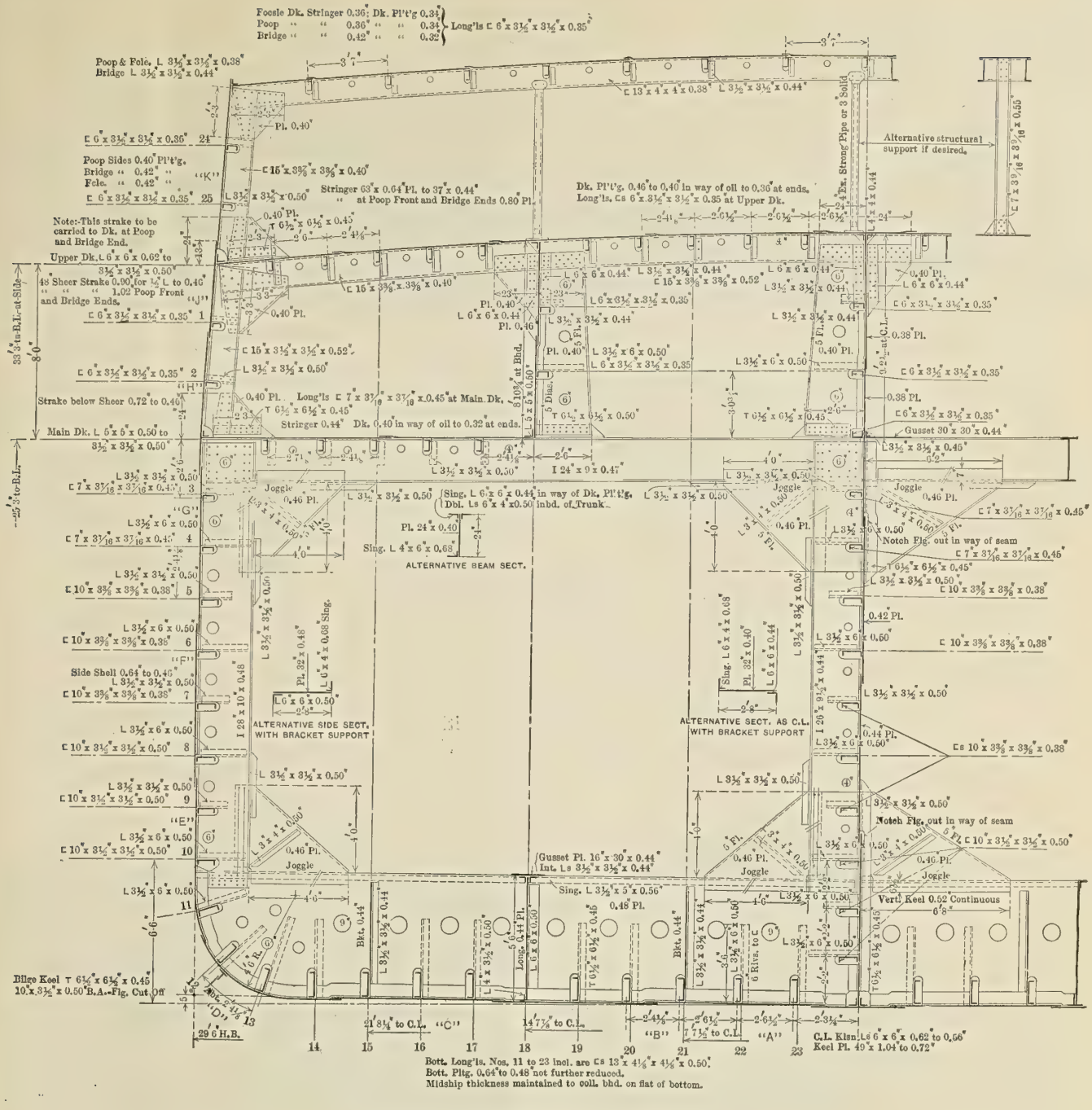


Fig. 6.—Midship Section, Showing Scantlings

located at the foremast and abaft the houses on the poop deck.

Hull Construction

The stem and stern frame are of cast steel. The rudder is of the single plate type with forged post, and is arranged so that it can be shipped or unshipped afloat.

The centerline vertical keel is fitted continuous in the inner bottom aft, connected to the flat plate keel and center strake of the inner bottom by angles. In the boiler room and cross bunker forward of the boiler room it is watertight. Through the holds the vertical keel forms the lower strake of the centerline oiltight bulkhead and is continuous the full length.

The centerline bulkhead is fitted throughout the cargo tanks, pump room, cross bunker and forward ballast tank. The bulkhead is plated in a fore-and-aft direction and cut at the transverse bulkheads. The bulkhead is stiffened by longitudinal stiffeners and by deep vertical webs at each transverse frame of the vessel. Arch openings are provided in the bulkhead in the pump room and cross bunker.

The transverse oiltight bulkheads are located as shown on the general plans dividing the hold into eighteen main cargo oil tanks, ten summer oil tanks, the pump room and cofferdams. These bulkheads are plated and stiffened horizontally and cut at the centerline bulkhead. Vertical web stiffeners are also fitted.

Watertight bulkheads are fitted to the after peak, forepeak, forward end of the boiler room, the bridge ends and elsewhere, as indicated on the general plans.

The expansion trunk between the main and upper decks is formed of continuous longitudinal bulkheads on each side of the centerline extending the full length of the main cargo tanks and cross bunker. These bulkheads have horizontal stiffeners connecting to the transverse bulkhead

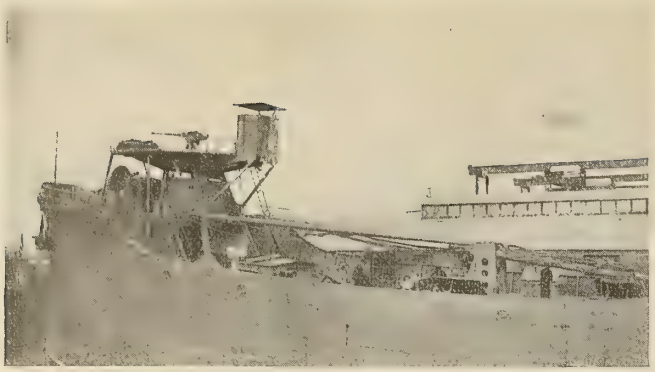


Fig. 7.—Bow of Vessel

Fig. 8.—Stern

stiffeners by brackets. Transverse vertical webs are fitted at each main transverse of the vessel.

The shell longitudinals are of the size and arrangement shown on the midship section, Fig. 6. They are generally of channel section or built of plate and angles where the shaping becomes excessive. For the most part the longitudinals follow the shell plate edges.

Although the hull is built according to the Isherwood system of longitudinal framing, the forepeak is framed on the transverse system from the keel to the forecastle peak. Transverse frames are fitted abaft the peak bulkhead between the upper and forecastle decks and in the after peak between the keel and upper deck, and also in way of the thrust recess from the keel to the dynamo flat.

The decks are all plated fore and aft. Overhead in the poop deck, in way of quarters, a wooden ceiling is fitted between the beams in place of sheathing. Alongside the cargo oil hatchways the deck plating is increased and compensation is fitted where required.

The deck beams are of channels and fitted longitudinally between the peak bulkheads on the main and upper decks. On the main, upper and forecastle deck forward of the peak bulkhead and for the full extent of the forecastle deck and on the main and upper decks abaft the after peak bulkhead, transverse deck beams are fitted to every frame. The beams on the bridge and forecastle decks are also of channel section and run longitudinally. Hold stanchions are fitted in the freight space forward and in the bridge 'tween decks.

Two fresh water tanks, having a total capacity of about 10,000 gallons, are fitted in the 'tween decks abaft the engine room.

Ventilating System

Two 24-inch cowl ventilators are fitted to the dry cargo hold, with trunks in the 'tween decks decreased in diameter, leaving an annular opening at each deck for ventilating the compartment below. One 12-inch cowl ventilator is fitted for the forward pump room.

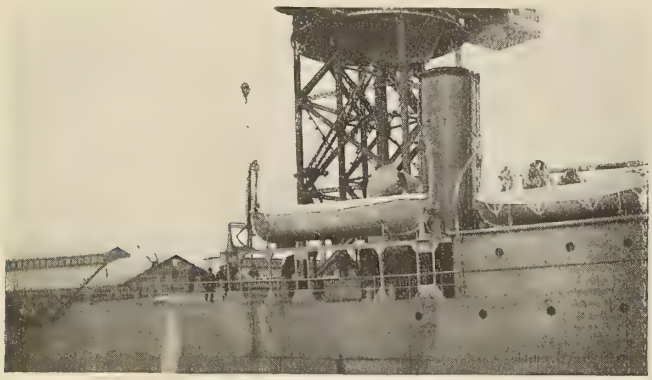


Fig. 9.—Forward End of Poop Deck

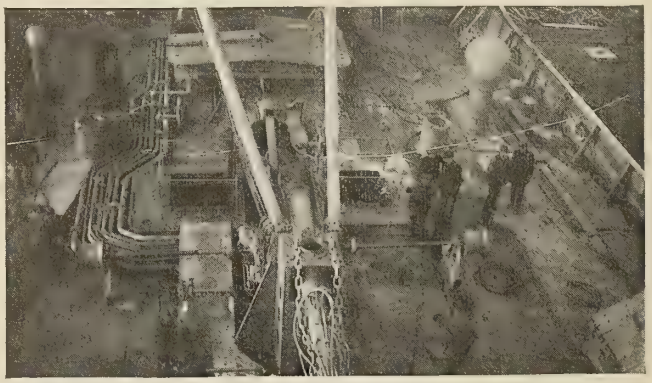


Fig. 10.—Mast Step

Fig. 11.—Runway on Upper Deck

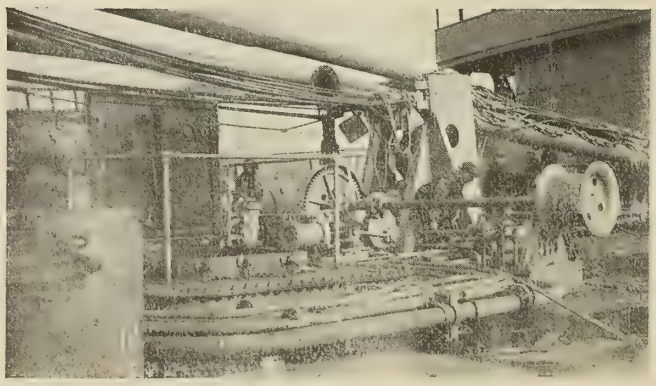


Fig. 12.—Hinged Mast

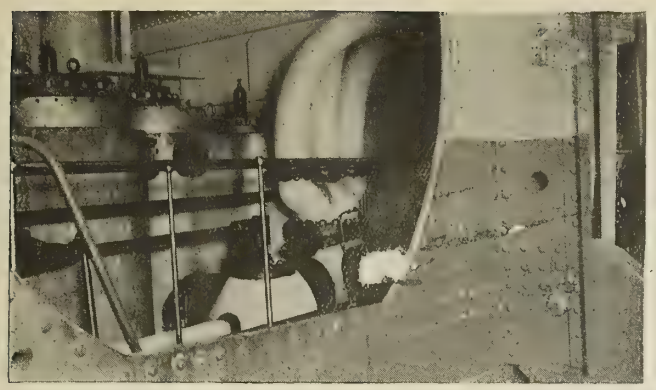


Fig. 13.—Upper Grating in Engine Room

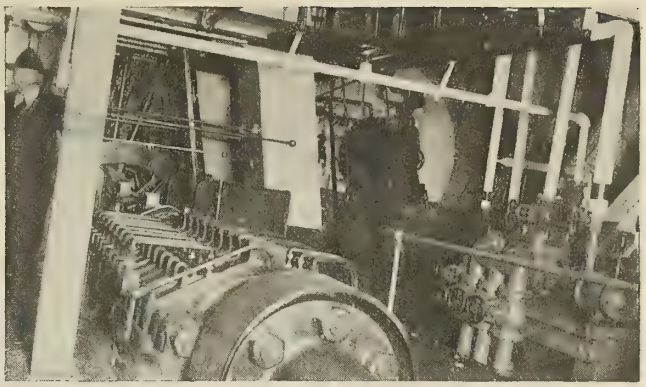


Fig. 14.—Thrust Block

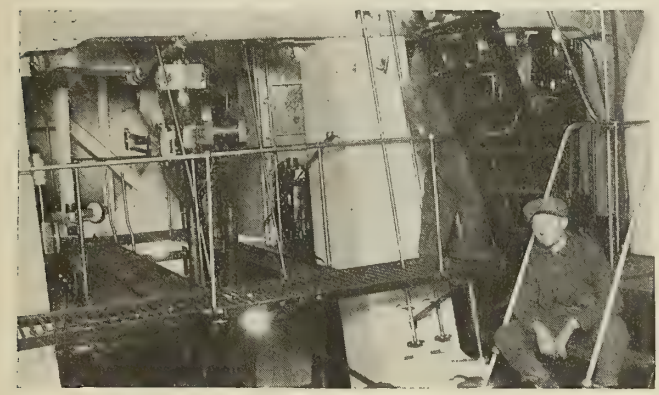


Fig. 15.—Lower Grating

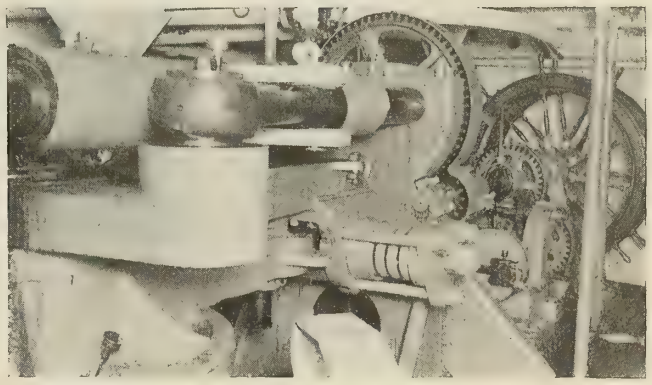


Fig. 16.—Steering Engine

The bunker space forward of the boiler room in the poop 'tween decks is ventilated by two 12-inch cowl ventilators. Two 12-inch cowl ventilators are also provided for the side bunkers and two more for the cross bunker. Two 18-inch ventilators are fitted to the steering gear compartments aft and 8-inch goose-neck ventilators are fitted to the storerooms below the upper deck.

Two 24-inch cowl ventilators are provided for the pump room amidships and the ventilation of the crew's quarters and machinery space is carefully worked out.

Propelling Machinery

Propulsion of the vessel is by a single screw driven either by a triple expansion reciprocating engine or by geared turbine machinery of about 2,700 shaft horsepower at 90 revolutions per minute. If a reciprocating engine is installed, it is of the triple expansion surface condensing type with cylidners 27 inches, 45½ inches and 76 inches diameter by 51 inches stroke.

The bedplate of the engine is of cast iron of box section. The cylinders are supported by six cast iron back and front housings of box section. To the back housing are attachments for the main air pump of the Edwards type and feed and bilge pumps.

The high and intermediate pressure cylinders are fitted with piston valves, while the low pressure cylinder is provided with a balance slide valve which is equipped with a balance cylinder with connections to the condenser. All of the valves are operated by the Stephenson link reversible valve gear.

The main condenser, which is independent of the main engine, has 5,000 square feet of cooling surface. For a reciprocating engine the condenser is designed to maintain a vacuum of 26½ inches with circulating water at 86 degrees F., while for a geared turbine arrangement the vacuum required is 28½ inches with water at 75 degrees F.

If turbine machinery is installed an independent air pump of the twin beam wet and dry type is provided, 14 inches by 32 inches by 21 inches. In this case the engine room bilge pump is a horizontal duplex pump 6 inches and 5¾ inches by 6 inches. The main feed pump for turbine drive is a vertical simplex, 12 inches and 8 inches by 18 inches.

Auxiliaries

The machinery equipment also includes the following pumps:

Auxiliary feed, vertical, single, long-stroke type, 12 inches by 8 inches by 18 inches.

Fire and bilge pump, horizontal duplex, 14 inches by 10 inches by 12 inches.

Water service and sanitary pump, horizontal duplex, 6 inches by 5¾ inches by 6 inches.

Fresh water pump, 5¼ inches by 4¾ inches by 5 inches.

Circulating pump, double suction centrifugal type, driven by single vertical engine.

Forward bilge pump, horizontal duplex type, 6 inches by 5¾ inches by 6 inches.

Bilge pump in pump room, 6 inches by 5¾ inches by 6 inches.

Salt water feed pump, 5¼ inches by 4¾ by 5 inches.

The auxiliaries also include an evaporator having a capacity of not less than 30 tons in twenty-four hours.

All accommodations are heated by steam taken from the auxiliary line in the engine room.

The vessel is lighted by electricity furnished by two 15-kilowatt marine direct-connected sets driven by vertical engines, located on the main deck in the engine space.

The refrigerating plant consists of a 2-ton ammonia ice machine installed on the main deck in the engine room

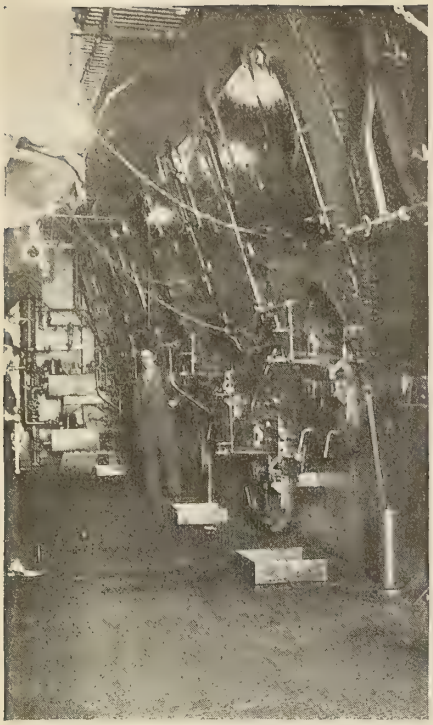


Fig. 17.—Fireroom

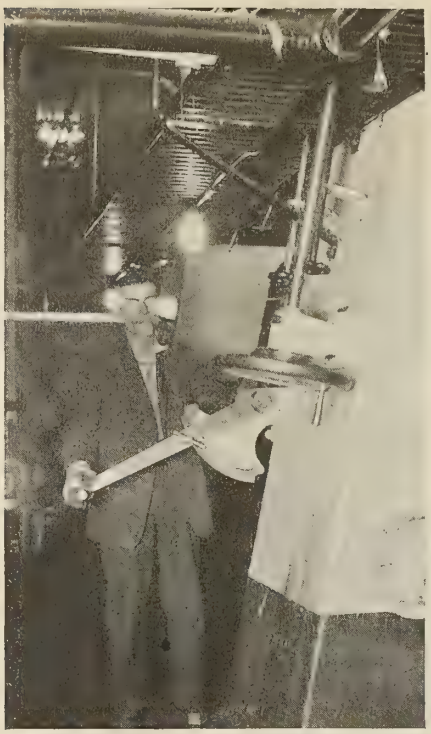


Fig. 18.—Operating Station

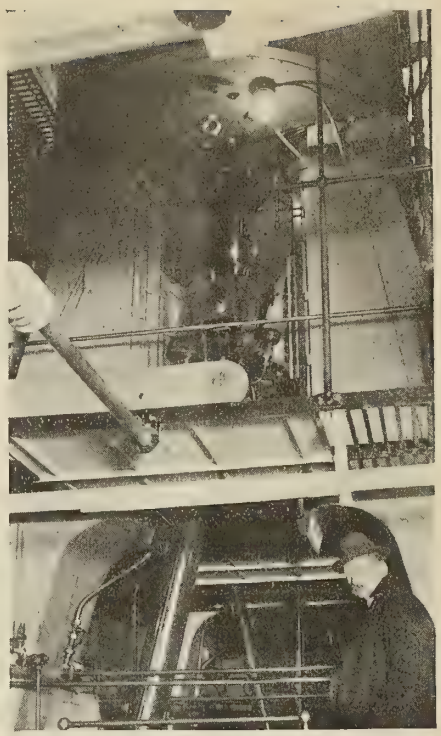


Fig. 19.—After End, Main Engine

and supplied with steam from the auxiliary line. The ice machine is connected to the cold storage room and is also fitted with ice-making pans of sufficient size to provide 200 pounds of ice daily.

Cargo Oil System

Two cargo oil pumps of the horizontal duplex type, each 16 inches by 14 inches by 18 inches, are fitted, one on each side of the pump room amidships with both suctions and discharges cross-connected, so that either pump may draw from the port or starboard main and discharge into the main on the opposite side. They may also draw from the forward mains and discharge into the after mains and vice versa. The discharge of each pump is fitted with a relief valve discharging back to the pump suction.

A 10-inch sea suction is fitted on each side of the pump room cross-connected in such a manner as to allow the tanks to be filled by gravity.

Each pump is fitted with a 10-inch delivery pipe carried up through the pump room to the athwartship discharge

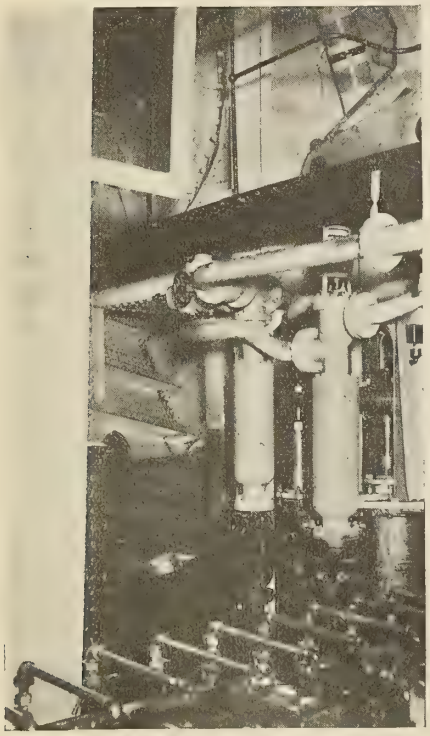


Fig. 20.—Attached Pumps

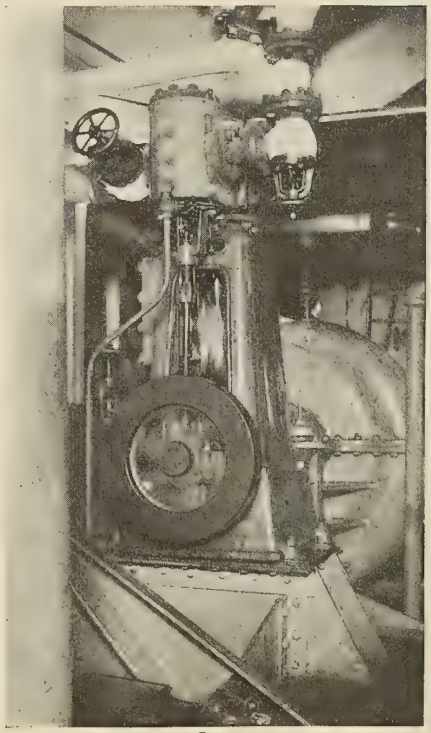


Fig. 21.—Circulating Pump

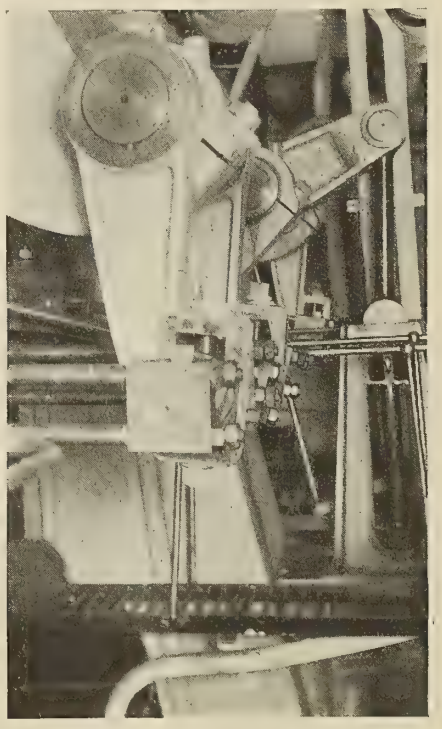


Fig. 22.—Reversing Gear

main. This delivery pipe is also connected to the pump suctions so that the athwartship mains may be used for either taking on board or discharging oil by the cargo pumps.

Two suction mains, 10 inches in diameter, run throughout the length of the ship, one on the port and the other on the starboard side, with 8-inch bell-mouth suctions in each tank, fitted with cut-out valves operated from the deck. The suction mains are cross-connected in the forward and after tanks with division valves operated from the deck.

All main lines are fitted with steam connections for blowing them out.

The summer tanks are fitted with deck valves at the lowest part of each tank for filling from and draining to adjacent main cargo tanks. The valves are operated from the deck.

Expansion in the main lines is provided for by the use of cast iron expansion joints with brass glands.

All cargo tanks are fitted with 5-inch vent pipes and relief valves. Each main cargo tank has heater coils fitted consisting of 1½-inch wrought iron pipe along the ship's longitudinals and around the bell-mouth suctions. Drain valves, operated on deck, are located in the summer cofferdams, draining into the main cofferdams.

Main Boilers

Steam is supplied at a working pressure of 190 pounds per square inch from three single-ended Scotch return tubular boilers, 15 feet 3 inches outside diameter and 11 feet 5 inches long between heads.

In place of Scotch boilers, watertube boilers of an approved design and type, with a working steam pressure of 200 pounds per square inch, may be used. In this case the heating surface is to be not less than 9,000 square feet. With turbine drive superheaters are fitted of a size sufficient to heat the steam 75 degrees F. above the temperature of the saturated steam.

The boilers are fitted for burning oil as fuel under a mechanical atomizing system, although they can be arranged for coal firing if desired. For oil burning a horizontal duplex pump, 7½ inches and 6 inches by 10 inches, is installed in the fireroom for pumping oil from storage tanks and discharging to a settling tank. The entire bottom of the storage and settling tanks is covered with heating coils of 2-inch pipe.

Two horizontal duplex pumps, 5¼ inches and 3½ inches by five inches, are fitted to draw from the settling tanks and discharge through strainers and oil heaters to the burners. Two fuel oil heaters and duplex suction and discharge strainers are provided in the oil lines, so arranged that either strainer can be cleaned without shutting down the pumps.

If Scotch boilers are installed, a forced draft system of the hot air type is provided, air pressure in the ash pit equal to a column of water 1 inch in height being maintained by a single blower installed in the engine room and driven by a vertical engine. If watertube boilers are installed, an induced draft system may be provided, consisting of a fan in the uptake driven by a single cylinder inclosed engine with automatic lubrication.

Trials

The specifications call for a dock trial of the vessel when completed, with the engines working full speed at full boiler power, with 1½ inches air pressure in the furnaces, and a six-hour sea trial with the ship loaded or ballasted to a mean draft of 25 feet. During this trial a speed of not less than 10½ nautical miles per hour must be maintained.

Working of Air Pumps Investigated by North-East Coast Institution

INVESTIGATIONS into the working of condenser air pumps recently begun by a committee of engineers appointed by the North-East Coast Institution of Engineers and Shipbuilders will include air pumps of the reciprocating type and of the rotary and jet types. A report has already been made which deals with tests made on pumps of the reciprocating type only. The point of chief technical interest is the fact that the tests have demonstrated that remarkable influence in the withdrawal of air from a condenser is possessed by a steam jet or a series of jets when used in combination with such pumps.

It is also of particular moment to note that, while the use of a steam jet has hitherto been associated mainly with the production of high vacuum such as is required for steam turbines, the report makes it clear that, for the production of low vacuum such as is standard for the reciprocating engines of cargo vessels, the jet system may be even more effective.

The original conception of combining a steam jet with an air pump was due to Mr. James Atkinson, of London, who in 1884 proposed it in connection with the cooling of liquids under high vacuum. In 1902 it was developed by Sir Charles Parsons for use with steam engine condensers, and at later dates has been considerably improved by Mr. D. B. Morison, of Hartlepool. These improvements, known as the kinetic system, are dealt with in the report, together with various other systems now in general use.

From the standpoint of economy, the effects of the adoption of the jet system are evidently extremely valuable. As is well known, a reciprocating air pump is a highly important auxiliary on a steamship. Its cost depends on its size; its wear and tear on its speed of working, and its economy in operation on the quantity of steam that it uses. The report shows that for a given duty the combination of a steam jet on the kinetic system will allow the speed of a given pump to be reduced from sixty strokes per minute to twenty and the consumption of steam to be reduced by one third, the pump mechanism remaining exactly as at present. Alternatively and obviously, the pump may be made smaller for a given duty, or, in the case of cargo vessels in which the air pump is driven by the main engines, the entire economic influence of the steam jet may be utilized in reducing the size of the main condenser and the pumps in connection therewith. Herein lies the present value of the report.

At no time in industrial history have savings in the use of labor and of metals been of such paramount importance as now. Apart altogether from the technical value of the results obtained, the investigations just completed indicate how such savings can be made in the manufacture of a particular part of the equipment of a steamship. The lead given by the North-East Coast Institution in the matter of active research, with the practical demonstration of how labor and material can be saved in manufacture, and, as in this case, higher efficiency obtained in operation, becomes, therefore, of national importance, and should at once be followed by every engineering institution.

The committee appointed by the Council of the North-East Coast Institution to carry out the tests outlined above consisted of Mr. Edwin Orde, of Messrs. Armstrong, Whitworth & Company, president of the North-East Coast Institution of Engineers and Shipbuilders; Dr. Morrow, M. Sc., of Armstrong College, the well-known authority on steam turbines; and Mr. Waldie Cairns, M. Sc., consulting engineer, of Newcastle-on-Tyne.

Eight Months of U-Boat Warfare

Evasion Proves Best Defense Against Submarines —Records Show German U-Boat Blockade a Failure

BY LEONARD M. PASSANO

ASIDE from the moral question as to the barbarity of submarine attacks as a method of warfare, upon which the civilized world is unanimous in condemnation, the submarine may be regarded from two points of view: First, as a means of warfare, and, second, as an instrument of warfare. It is particularly with the latter that the present article deals. It may be well, however, first to review the situation from the more general standpoint of the submarine as a means of warfare.

During the period from the week ending April 8 to the week ending December 9, 1917, the number of arrivals and departures of vessels from British ports was 188,012. In that period the number of vessels sunk by submarines was 826, or .44 percent. In a recent speech, Secretary Daniels asserted that "one thousand ships have been added to allied tonnage since entry of the United States into the war." The question of tonnage is as important as the question of the number of vessels. The incomplete evidence available indicates that the Allies have maintained the tonnage of their merchant fleets as well as the numbers. Undoubtedly, also, many enemy submarines have been captured or destroyed, so that even if Germany, at best, has been able to maintain the number of her U-boats, she is not accomplishing the destruction of Allied shipping. The submarine as a means of warfare must be pronounced a failure, though a danger and a menace.

In considering the submarine as an instrument of warfare three points must be dealt with. First, the ratio of the number of ships attacked to the number of arrivals and departures (sailings) at British ports; second, the ratio of ships sunk to sailings; third, the ratio of the number of ships which beat off attacks to the number of sailings. A fourth point, of perhaps secondary interest, is the ratio of ships sunk, and of ships which beat off attacks, to the number of ships attacked. Fig. 1 deals with the first three of these questions, Fig. 2 with the fourth. The amount of the tonnage attacked or destroyed is a secondary consideration from this point of view. The effectiveness of the submarine as an instrument is tested even more severely by a small ship than by a large one as far as finding the ship is concerned, and is tested in about the same degree by each in the sinking of the ship.

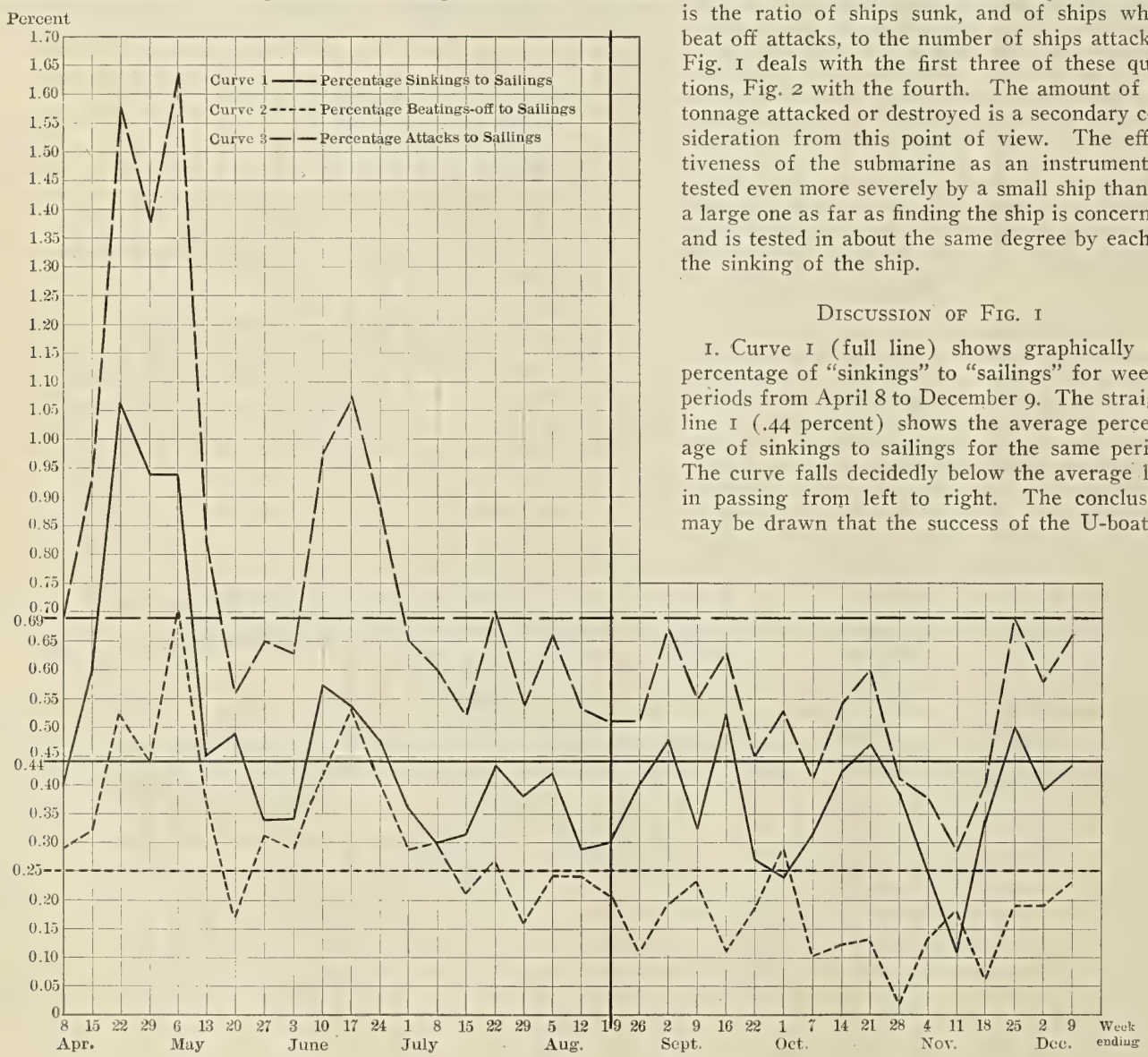


Fig. 1.

Discussion of Fig. 1

1. Curve 1 (full line) shows graphically the percentage of "sinkings" to "sailings" for weekly periods from April 8 to December 9. The straight line 1 (.44 percent) shows the average percentage of sinkings to sailings for the same period. The curve falls decidedly below the average line in passing from left to right. The conclusion may be drawn that the success of the U-boat in

destroying (in addition to finding or discovering) ships has decreased.

2. Curve 2 (dotted line) shows graphically the percentage of "beatings-off" to sailings for the same period. Straight line 2 (.25 percent) shows the average percentage of beatings-off to sailings. This curve also falls decidedly below the average line in passing from left to right, showing that the success of ships in escaping from, in addition to evading, the U-boat has decreased.

3. Since both the success of the U-boat in sinking ships and the success of ships in beating off attacks have decreased some common factor must be looked for as the cause. This common factor is probably the unfavorable weather conditions of fall and winter, which make it easier for ships to evade the submarine, but also make it easier for U-boats to do their work and escape when the victim is once discovered. Increased strength of convoys would suggest itself as another factor, since the convoy, by preventing the submarine's attack, would reduce both the percentage of beatings-off and of sinkings. As will be pointed out, however (paragraphs 7 and 8 following), there are reasons to believe that weather conditions are a factor of primary importance.

4. Curves 1 and 2, on being compared, show two markedly distinct periods. In the first period (April 8 to August 19) the curves rise and fall simultaneously, which indicates that good weather conditions (spring and summer) are equally favorable to U-boat and ship. In the second period (August 19 to December 9) the maxima, or highest points, of one curve correspond to the minima of the other. A possible explanation of this fact will be mentioned in paragraph 9 under the discussion of Fig. 2.

5. Curve 3 (dash line) shows graphically the percentage of attacks, successful and unsuccessful, to sailings for the same periods. The heights of curve 3 are, of course, the sum of the heights of curves 1 and 2. Straight line 3 (.69 percent) shows the average percentage of attacks; in other words, the average percentage of discovery of ships. That is, the submarine finds, on the average, 69 out of every 10,000 ships that enter or leave port.* Curve 3 falls very decidedly below the average line in passing from left to right, which indicates that the success of the U-boat in attack (i. e., in discovering ships) has decreased.

6. The principal cause of this decrease is, probably unfavorable weather conditions. (See paragraph 8.) On the other hand, the extreme height of curves 1 and 3 in the beginning is probably due to the sudden outburst of U-boat warfare after a long period of preparation. These extreme values make the average value of the percentages high and doubtless explain, in a measure, the failure of the U-boat to "come up to the average." The submarine is probably a more efficient instrument of war than curves 1 and 3 would indicate.

Doubtless, also, the destruction of U-boats faster, perhaps, than they can be built or replaced is another reason for the downward tendency of curves 1 and 3, while another factor of importance is that the number of sailings is less in the fall and winter months—the right hand half of the graphs. Fewer U-boats, fewer sailings, and bad weather would make the discovery of ships by the submarine more difficult. The following table shows the effect of the calendar on the number of arrivals and departures.

TABLE

April 8 to December 9

Average Number of Sailings	Greatest Number, June 17	Difference	Smallest Number, Nov. 25	Difference
5,223	5,890	+ 667	4,180	— 1,043

April 8 to August 19

Average Number	Greatest Number, June 17	Difference	Smallest Number, April 15	Difference
5,438	5,890	+ 452	4,710	— 728

August 26 to December 9

Average Number	Greatest Number, Aug. 26	Difference	Smallest Number, Nov. 25	Difference
4,953	5,709	+ 756	4,180	— 773

It must be borne in mind also that another possible factor in the decrease of the percentage of ships discovered and attacked is failure of the U-boat to obtain information as to sailings. Doubtless many sources of secret information have been discovered and suppressed.

Discussion of Fig. 2

7. Curve 1, Fig. 2 (full line) shows graphically the

* For the period April 8 to August 19 the number is 83 in 10,000; for the period August 26 to December 9, 52 in 10,000.

percentage of sinkings to attacks; straight line 1 (64 percent) the average percentage of sinkings.

Curve 2 (dash line) shows the percentage of beatings-off to attacks; straight line 2 (36 percent) the average percentage of beatings-off.

These two are, of course, complementary curves. Where one rises the other sinks proportionally.

The rise of curve 1 and the fall of curve 2, with reference to the average lines in passage from left to right, show an increase in U-boat success in destroying (not in discovering) ships and a decrease in the success of ships in beating off (not in evading) the U-boat.

8. It can hardly be assumed that the U-boat has become more skillful in attack while the ship has become, relatively, less skillful in defense. Probably the skill of both has increased. On the other hand, there is no reason to believe that more ships are sailing unarmed for defense, and there is reason to believe that more are being convoyed. The conclusion may be drawn, therefore, that bad weather conditions (fall and winter) are favorable to the submarine in sinking, though not in finding, ships.

9. The rise of curve 1 would explain also the reversal of maxima and minima in curves 1 and 2 of Fig. 1 for the period August 19 to December 9. Given bad weather conditions, in any week that a U-boat finds ships, it is likely to succeed in sinking a large percentage of them before they can prepare to beat off the attack.

Summary

10. The submarine as an instrument of warfare cannot be called successful, chiefly because of its failure to discover or reach its victims; but it is reasonably effective and increasingly so, relatively, in conditions of bad weather, if it succeed in finding the ships to be attacked. Good weather appears to be about equally favorable to U-boat and ship, the advantage, if any, being with the submarine. Ships armed for defense have a reasonable chance of beating off attacks in good weather; less chance in bad weather. Convoyance would appear to be a secondary factor (paragraphs 3 and 8).

11. The conclusion to be drawn is that every possible means should be employed to make the discovery of ships difficult. The strictest precautions should be taken that no information reach the submarine as to date, place or route of sailing. It is particularly important now at the approach of the good weather of spring, when renewed U-boat activity must be looked for, to realize that the safety of ships from submarine destruction depends not only upon defense, but also, and primarily, upon evasion; and this is particularly so because, though ships and tonnage may be restored, the cargoes of ships that are sunk are irretrievably lost. Evasion is the best defense against the submarine, considered either as an instrument or as a means of warfare.

Diesel Piston Cracks

UNDER the direct influence of heat, cast iron cylinder components in internal combustion engines frequently crack and become utterly useless, in many cases after a short period of life. Piston heads have, undoubtedly, to stand very high temperatures during working. In an ordinary four-cycle gas engine at full load the center of the piston head may seem to be at a dull red glow, approximately 650 to 700 degrees C., and in the Diesel engine the temperature of the inner surface in the center of the piston head, directly in line with the fuel admission valve, is at least 900 to 950 degrees C. In many cases "star cracks" in Diesel engine piston heads can be traced to mechanical defects, such as bad designs or defective cooling arrangement, which under the influence of heat tend to set up unequal strain in the material, a state of affairs which under the conditions of working—the high temperatures and high alternating gas pressures—is extremely likely to bring about fracture.

The only change indicated by analysis of cast iron taken from various positions in cracked Diesel engine pistons is in the condition of the carbon content, the combined carbon being practically wholly converted into free or graphitic carbon. There appears to be no indication of the oxidation of the carbon or silicon contents. In experiments with gray cast iron bars which were heated in an open iron tube and quenched in water at the room temperature, the combined carbon was rapidly converted into the free carbon form at 750 degrees. Also it appeared that a temperature between 750 and 900 degrees had little influence on the rate of decomposition, nor did any influence appear to be exerted by the varying phosphorus content (0.016 to 0.85 percent). In samples of gray cast iron heated to between 900 and 950 degrees, analysis showed the reabsorption of a portion of the free carbon; one sample in which the reabsorption had probably reached its maximum for the temperature, was perfectly glass hard. This sample contained 1.13 percent of phosphorus.

While a microphotograph of a portion of a cracked Diesel engine piston, well away from the area affected by the heat, showed the normal structure of a low phosphorus gray cast iron, another of a portion directly affected by the heat exhibited an enormous increase in the dendritic structure, and the whole of the matrix appeared to be intersected by graphite plates. Near the extreme upper edge of the piston, directly in contact with the flame, the extent of the dendritic structure was much less, and the matrix appeared to be dotted with many more finely divided graphite plates. Also what seemed to be numerous small holes might be noticed. In photographs of the first set of gray cast iron bars mentioned, after heating for eighty hours (8 hours a day for ten days), numerous curly plates of free carbon were visible, and in the second set most pronounced swelling of the graphite plates was observed. This swelling, or rather the replacement of the graphite plates by holes, is in some way connected with the reabsorption of the free carbon. The swelling and thickening of the worm-like graphite forms may be seen in all the heat-treated samples, and it may be concluded that as a result of the internal changes, which take place only in a localized portion of the piston top, the iron is rendered considerably weaker, and the slight exterior changes will be responsible for a condition of internal strain.

Apart from mechanical defects, the ultimate cracking of Diesel engine piston tops can as a general rule be ascribed to the high phosphorus content of the iron. By reducing the phosphorus to the lowest possible limits it has been found possible to prolong the life of the pistons considerably and practically to eliminate the troublesome cracking. —*From a paper by J. E. Hurst before the Iron and Steel Institute.*

A clean fire and clean tubes make for good steaming.

It is astonishing how cool the engine and fire rooms are to the captain in the pilot house. It is a West Indian proverb which says, "The stone in the river bottom does not know how hot the sun is."

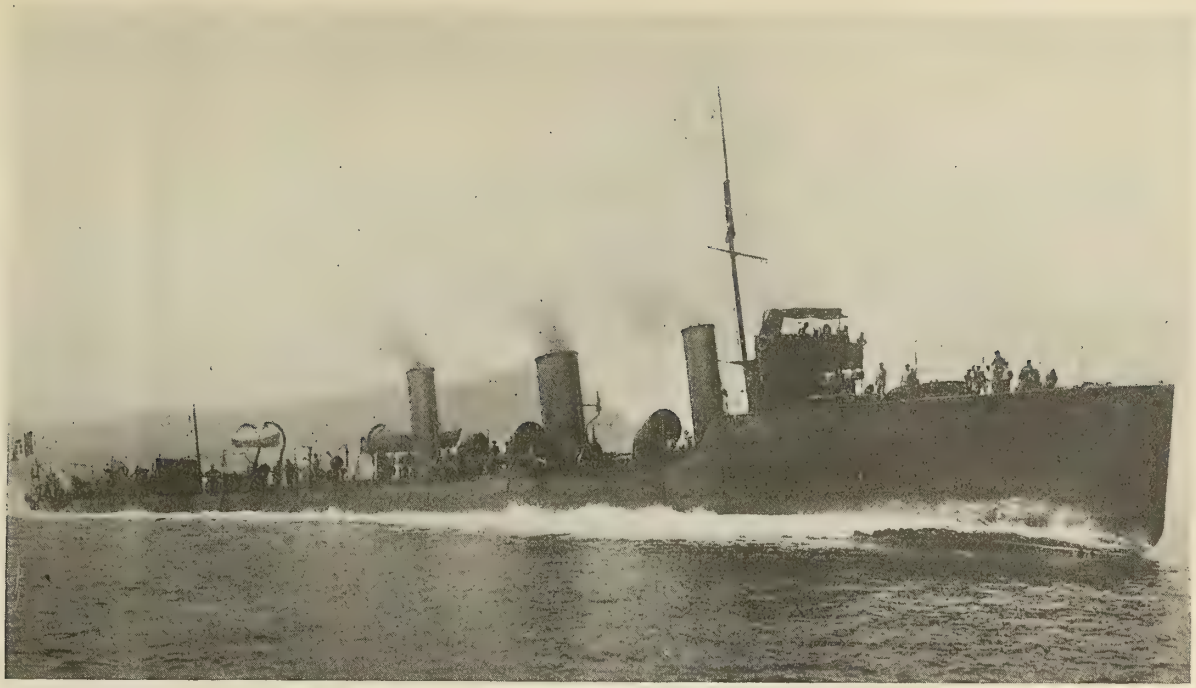


Fig. 1.—Italian Destroyer *Indomito*, a 680-Ton Vessel, Equipped with Tosi Turbines of 15,000 Horsepower. Speed on Trial, 35 Knots; Maximum Speed, 37 Knots

Tosi Marine Steam Turbines

Types of Turbines Built by Firm of Franco Tosi, Legnano, Italy, for Naval and Merchant Vessels

IN view of the widespread adoption of steam turbines for the propulsion of both naval and merchant vessels, readers of MARINE ENGINEERING, will undoubtedly be interested in the developments which have been made by the firm of Franco Tosi, Legnano, Italy, the largest firm of steam turbine builders in Italy. For many years this firm has been engaged in the building of steam turbines, and have so far built turbines aggregating over 1,100,000 horsepower, in units varying from 12 horsepower up to 25,000 horsepower. Of these more than 800,000 horsepower have been for marine purposes. This firm to-day employs about 6,000 men in its shops.

The type of turbine adopted by this firm is shown in Fig. 2 and consists, as can be seen from the illustration, of one impulse wheel and one reaction drum, the latter constituting the intermediate pressure and low pressure stages of the turbine. If the turbine is built for a stationary plant it is built in one drum. If, on the other hand, the turbine is designed for naval work with reduction gears, it would be built in two drums, one for high pressure and the other for low pressure.

For low powered turbines, or for turbines with medium or high power, but which have a high speed, if the intermediate stage were built complete as a reaction tur-

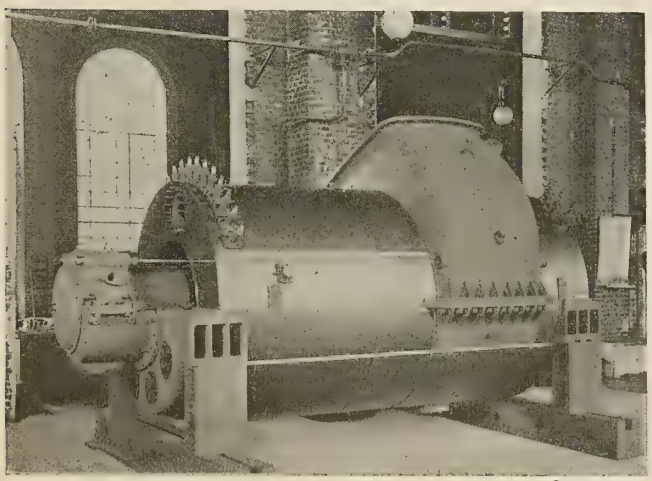


Fig. 2.—9,000-12,000 Horsepower Turbine, 750 Revolutions per Minute

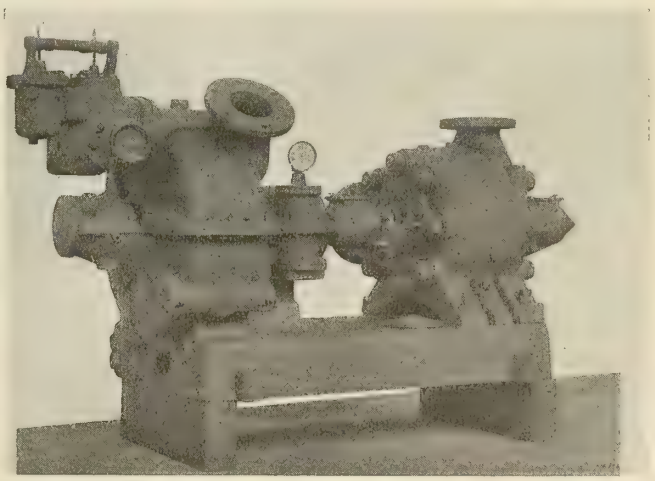


Fig. 3.—Turbo Boiler Feeding Pump

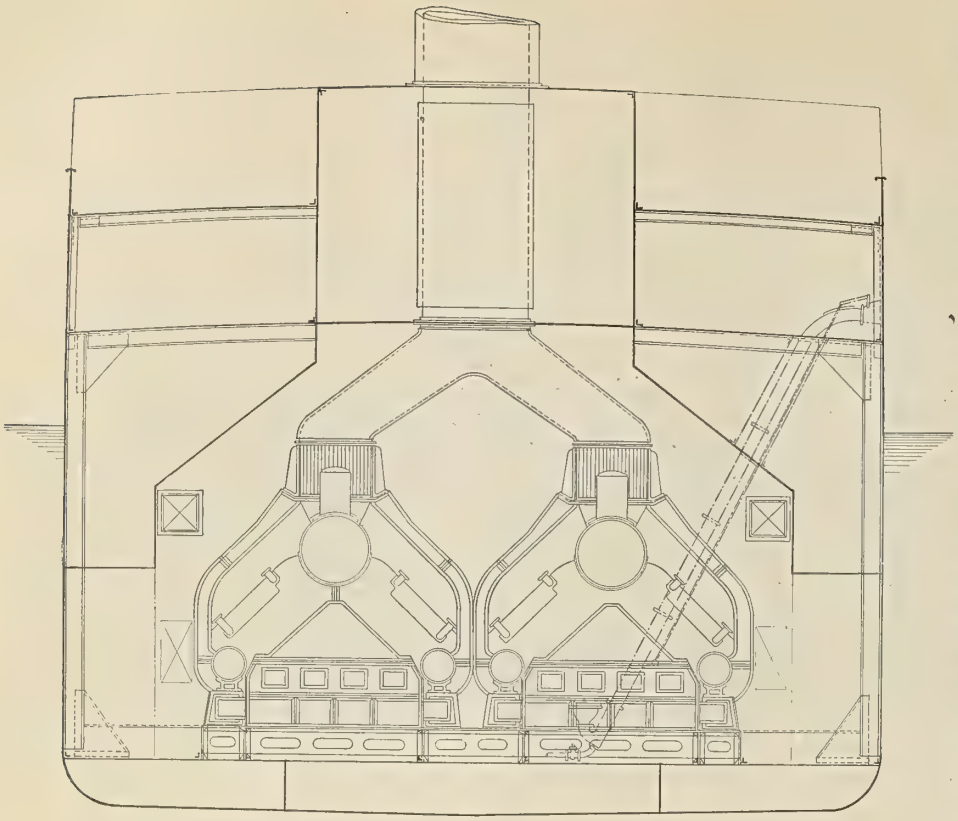


Fig. 4.—Section Through Boiler Room, 3,000 Horsepower Cargo Steamer

bine the resulting efficiency would be too low because the first rows of blades would be too small; therefore, instead of using only one drum, this firm makes use of the two impulse wheels and one reaction drum. In marine turbines for direct drive, that is, coupled direct with the propeller shaft and, therefore, designed to work at relatively lower speeds, it would be of little advantage to adopt only a one impulse wheel and one reaction drum for the intermediate and low pressure stages, because the blades of the reaction drum, especially in the first rows, would be too small for efficient operation and, in consequence, the efficiency would be poor. For this reason, the Tosi firm builds turbines in which the impulse parts are increased and reaction parts diminished. This method has the advantage that the thrust which the steam produces at the beginning of the low pressure stage of the turbine is directly equal to the propeller thrust.

Figs. 4-7 show the machinery arrangement for an installation of a 3,000 horsepower turbine for a cargo boat as built by the Tosi firm for different owners. Double reduction gears are provided which reduce the turbine speed from 2,700 revolutions per minute to 80 revolutions per minute. The gears are constructed in such a manner that they insure perfect working at any speed.

A characteristic part of the Tosi turbine, which is patented, is the strong construction of the blades, which will be noted from Fig. 11.

The stuffing boxes are protected by protection boxes in such a manner that if the stuffing boxes should come in contact with a stationary part of the turbine the danger of ruining the shaft is eliminated. This feature avoids the extensive repairs which would be caused by a ruined shaft, as all that would be necessary would be to renew the protection box. The labyrinth packing is of the carbon ring type with equilibrium rings to balance the proper weight.

In this case a 60 horsepower turbine drives the centrifugal circulating pumps, the oil pumps for the whole service and the condensed steam-extracting pump. The oil pump, which is of the rotary type, serves to supply oil to the main turbines, to the reduction gear and to the centrifugal boiler feed pumps.

The turbo boiler feed pump, driven by a two-wheel impulse turbine, is shown in Fig. 3. Turbo blowers serve to put the whole blower room under a pressure of one inch of water. They are of the high speed turbine type and run at about 6,000 revolutions per minute.

The condenser is located underneath the low pressure turbine, in such a manner that the flow of the exhaust steam is much more regular and the danger of water being retained in the turbine is eliminated.

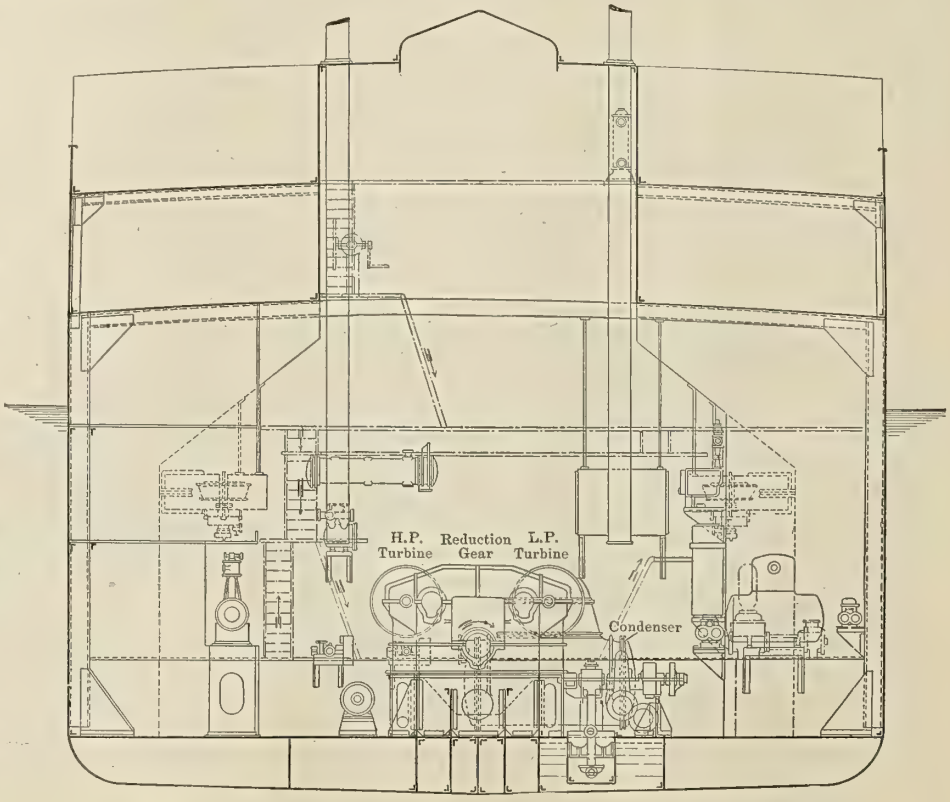


Fig. 5.—Section Through Engine Room, 3,000 Horsepower Cargo Steamer

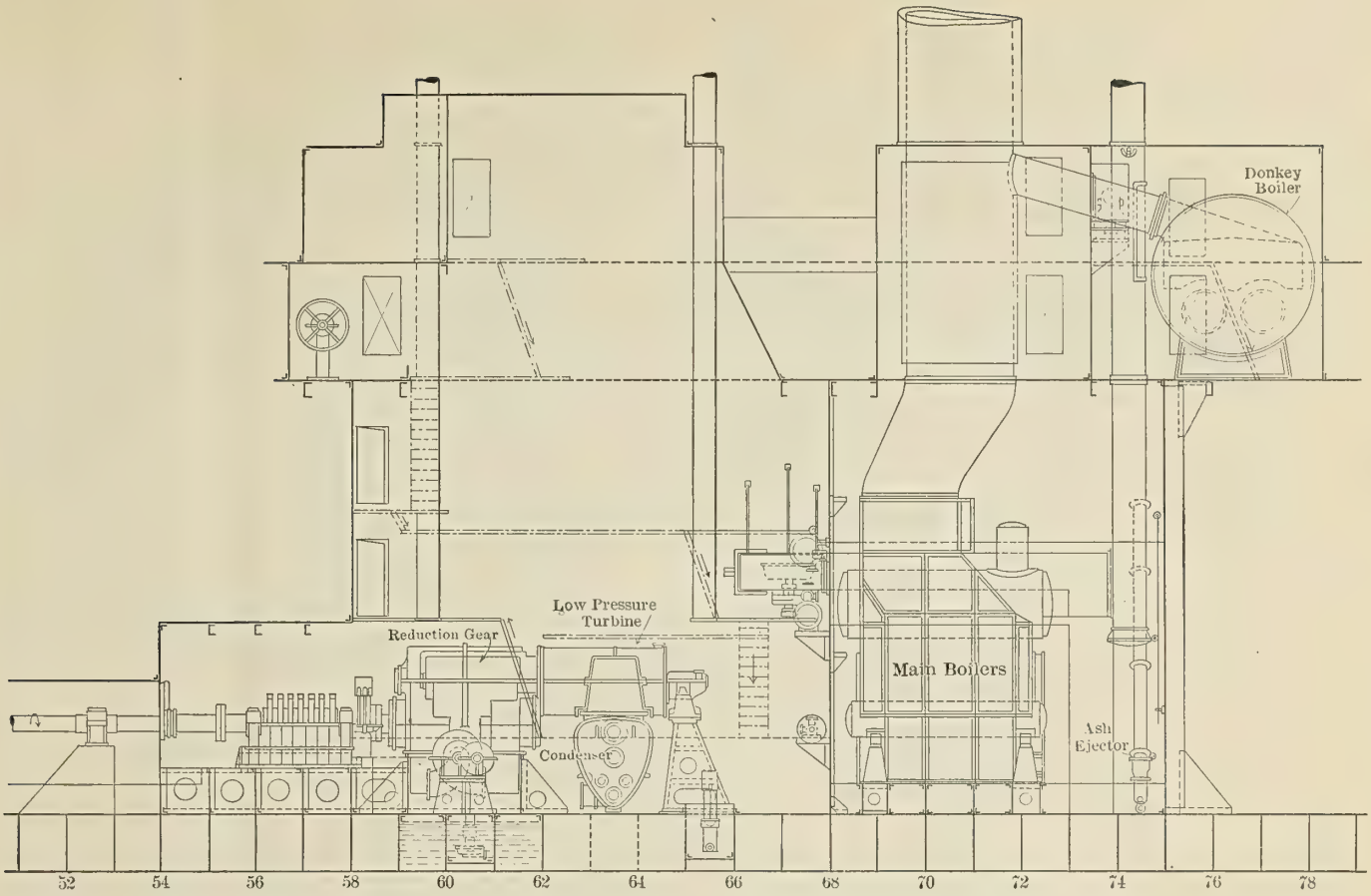


Fig. 6.—Longitudinal Section Through Machinery Space, 3,000 Horsepower Cargo Steamer

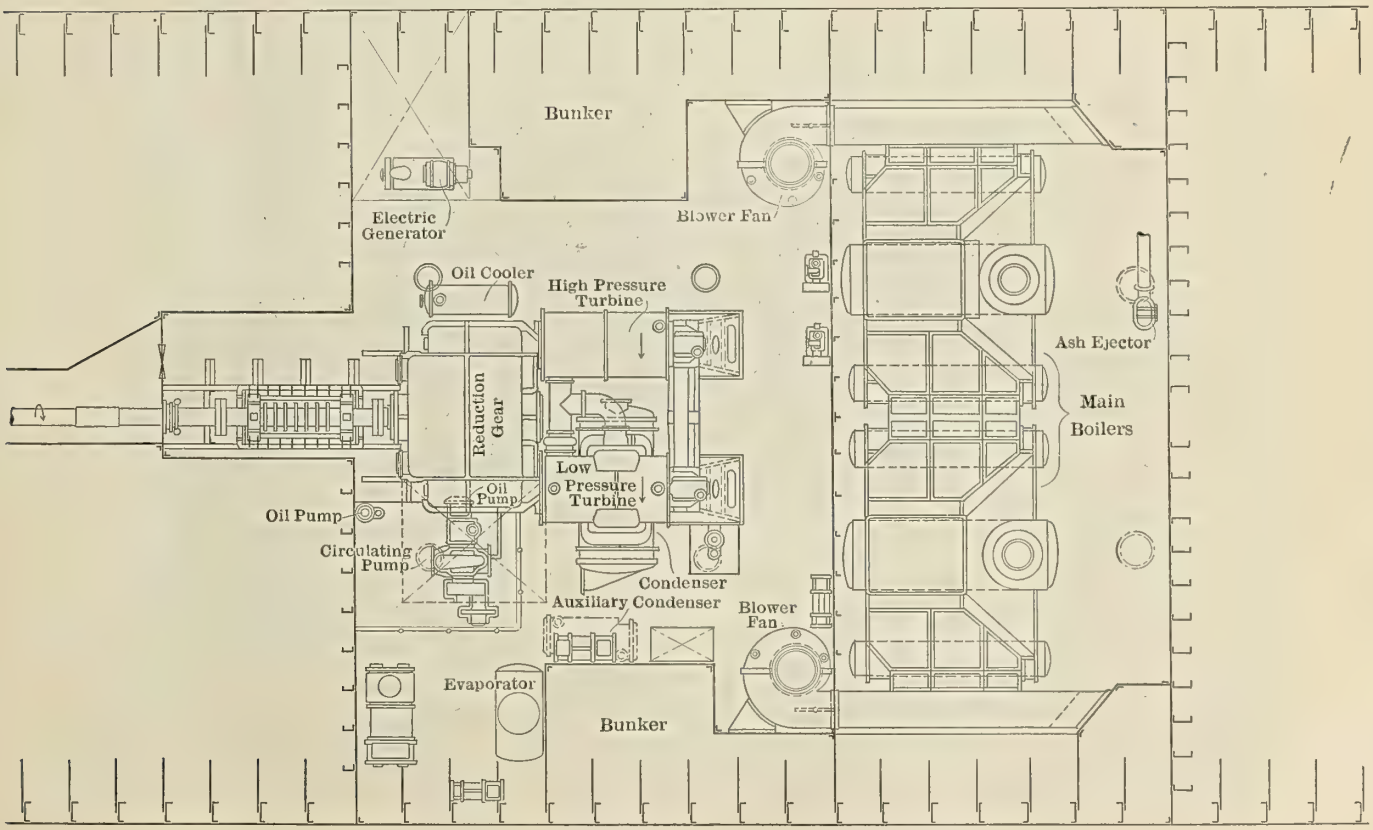


Fig. 7.—Plan of Machinery Space, 3,000 Horsepower Cargo Steamer

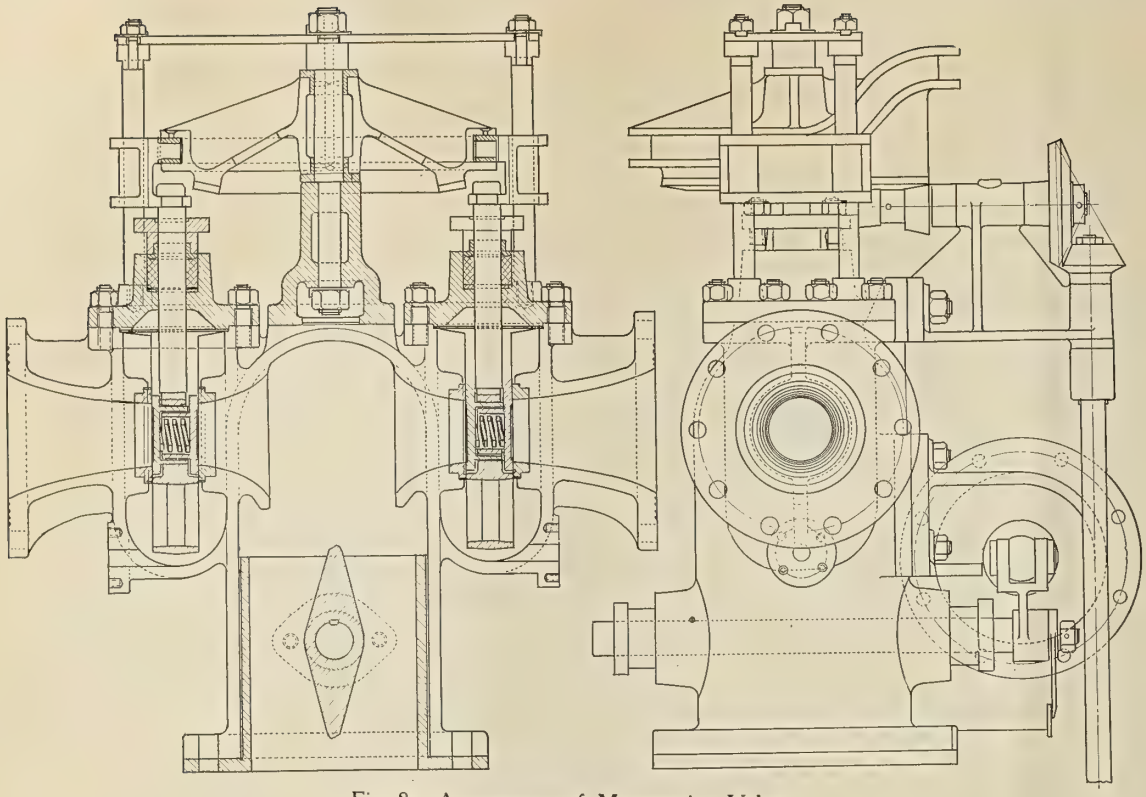


Fig. 8.—Arrangement of Maneuvering Valves

The arrangement of the maneuvering valves is interesting. These valves are of the double-face sluice gate type of very light construction, which are kept tight by steam pressure. The maneuvering is done by hand and is interlocked in such a manner that it is impossible to open the hand valves for the ahead turbine if the valve of the astern turbine is not closed or vice versa. A speed governor is placed at the end of each main turbine, which governs the speed of the turbine. If the speed of the propeller, due to the movement of the ship raising the propeller out of water should rise 20 percent above the normal speed, the governor would automatically let out oil through a small valve which is placed at the head of the turbine itself, so that the oil pressure would be decreased under a piston

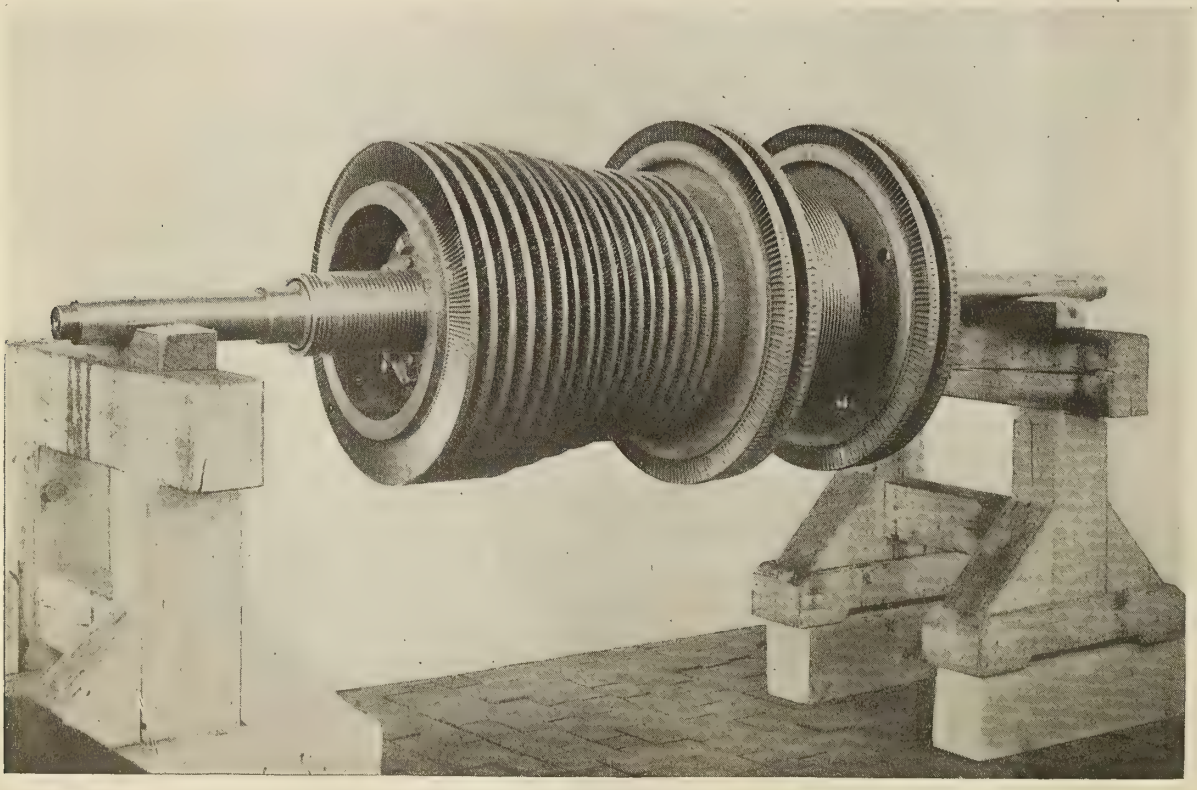


Fig. 9.—Rotor of 7,000 Horsepower Turbine

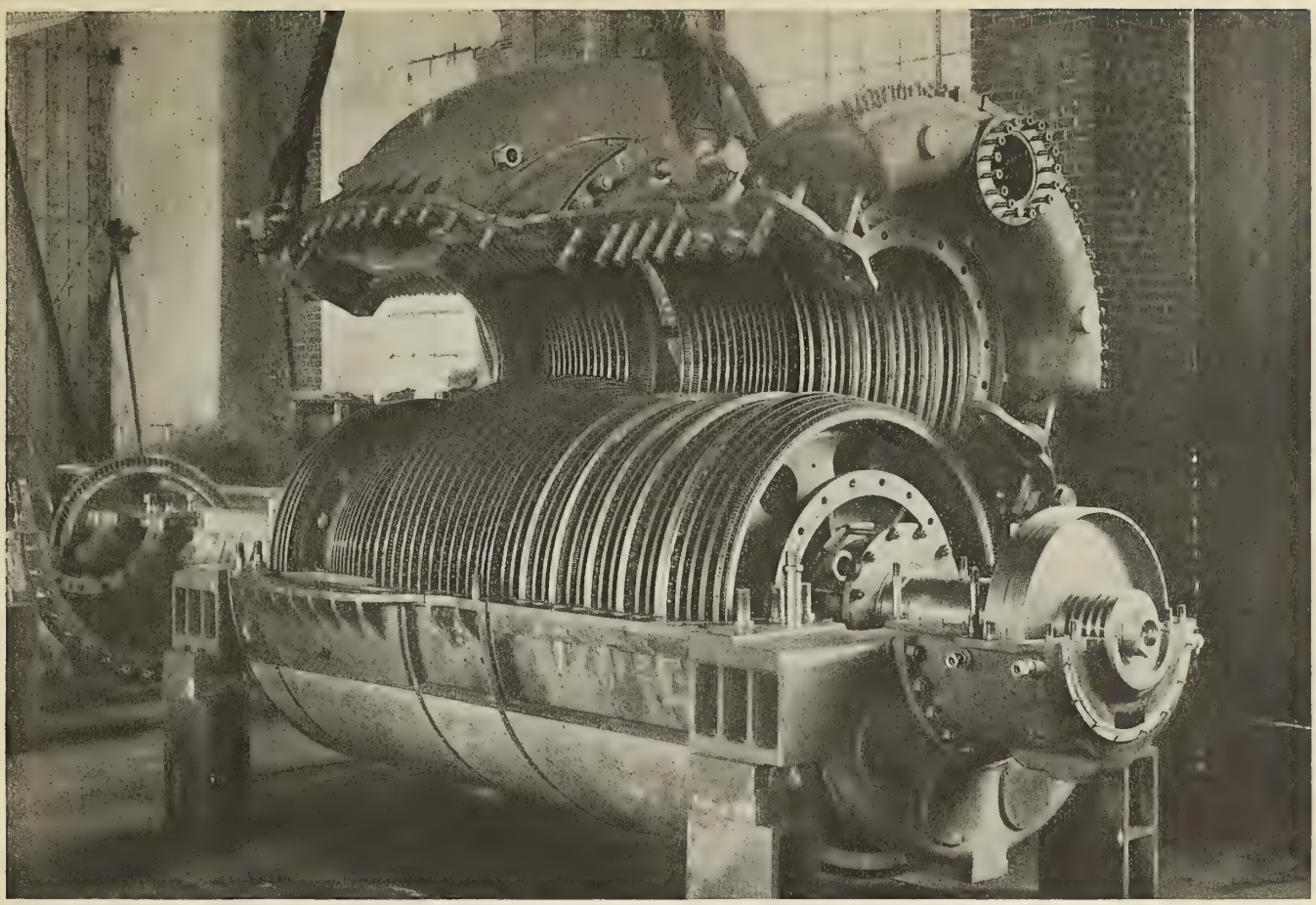


Fig. 10.—20,000-25,000 Horsepower Marine Turbine, Designed to Run at 500 Revolutions per Minute

and by means of a system of springs this piston would close a butterfly valve which is built in the steam piping system of the turbine.

The exhaust steam from all of the auxiliaries is conducted in the usual way into the low pressure turbine, but when it becomes necessary to operate the astern turbine, a special valve automatically delivers the exhaust steam from the auxiliaries directly to the condenser.

It is of special interest to note that the Tosi naval turbine has:

1. Few but very strong blades.
2. Very rigid drums.
3. Protection boxes against friction of the parts with very little clearance.
4. These turbines can be put into action very readily so that on a vessel with a 25,000 horsepower turbine starting with cold boilers it is possible to reach full speed within twenty-five minutes, as it is unnecessary to pre-heat the turbines for seven or eight hours, as in other types of turbines.

As can be seen from the general arrangement of the machinery for a cargo boat, Fig. 4, the boilers used in connection with these turbines are of the watertube type. They are fitted with a superheater and with an arrangement to heat the air from the products of combustion before the air reaches the grates.

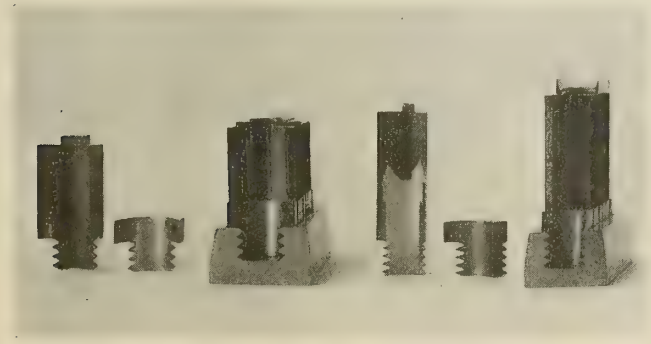


Fig. 11.—Blading from Tosi Marine Turbine

When you have an automatic feed or anything which is supposed to work itself, it will pay to watch it. No piece of machinery thinks.

Almost any man can see if a thing is wrong. It is a good man, however, who knows how to make a wrong thing right and such a man is not to be found on the bargain counter.

It is strange to hear so often from the chief water tender that the boiler that blew up had had half a gage glass of water not two minutes before the boiler let go. That's the time when the man lied.

A fireman went to his chief and said, "I am saving you a ton of coal a day over what you have been burning, and I think I should have more pay." The chief replied, "If you are not shoveling as much coal as did the old fireman, you are doing less work, so you should not ask more pay for less work." There are many just such short-sighted chiefs, and they are the cause of many labor troubles.

Repairing German Vandalism on Interned Vessels by Electric Welding*

Damaged Machinery Repaired by Electric Welding Apparatus—No Failures in Any of the Welds—Vessels Ready When Needed

BY COMMANDER E. P. JESSOP, U. S. N.

ON April 6, 1917, the interned German and Austrian vessels located in the port of New York were taken over by the collector of customs for safekeeping, the crews being interned.

The vandalism on all these vessels was, in general, the same, which would indicate that general instructions had been issued to all commanding officers by the same agent. It also appears that the parts damaged, as a rule, were those probably on hand as spare parts in the home ports of the vessels. In case this country did not enter the war the ships could be again commissioned by utilizing spare parts already provided.

Board of Railway Engineers Appointed

It was appreciated that the rapid repair of these vessels was of the greatest importance, and to that end the collector appointed a board of railway engineers to investigate the damage to the machinery to these vessels with a view to the use of electric welding where it could be done satisfactorily. This board, headed by the consulting engineer of the Erie Railroad, consisted of the electrical engineer of the New York Central, the mechanical superintendent of the Erie, one general foreman from the Erie and one general foreman from the New York Central. The railroad engineers were probably the only ones in this country who had made any extensive successful use of electric welding in connection with cast iron.

The Shipping Board had also appointed a board of engineers to inspect these vessels. The inspections by these two boards were made at the same time, although the boards worked separately. The report of the board of engineers for the Shipping Board recommended the renewal of all cylinders which were badly damaged. These recommendations were made without any idea of the use of electrical or other methods of welding, and were therefore not of any use as to time and cost if welding processes were applied. The report of the electric welders committee was unanimous in stating that all damaged cylinders could be reclaimed.

Opposition to Electric Welding

Great opposition to the electric welding of cast iron cylinders developed among certain engineers and it was with the greatest difficulty that consent was obtained for a trial of this method. With so much at stake, and considering the time element, the logical procedure would be to repair one cylinder by this method and to put this cylinder through a series of drastic tests. Unfortunately this method was not pursued, and the controversy with regard to the methods to be applied in these repairs continued until the larger vessels were turned over to the Navy Department to be fitted as transports, about the middle of July, 1917.

All told, the principle of electric welding has been applied to fifteen ships in the port of New York. Of these ships, all are in commission and will probably be ready for service before this article appears in print. In no case known to the writer will the repairs to the propulsive machinery of the vessels delay them beyond the time necessary to equip them as transports. In other words, by the use of electric welding all of the vessels will have been gotten out as quickly as would have been the case had no damage to the main machinery been done by the Germans, the vessels being in other respect badly run down and in need of extensive overhaul.

Control of Current Essential

In order to successfully weld with the electric arc it is necessary to have complete control of the current. The arc must be directed along the line of fracture to be welded. Welding must be done slowly, the metal being laid on layer by layer, and each layer must be calked and peened to knock or chip out the metal that has oxidized or hardened. Cast iron is not welded to cast iron direct. Special alloy steel wire is used to supply the welding metal. In welding two cast iron edges together a layer of steel is welded to each, and then these steel layers are welded to each other. It is difficult to weld two cast iron parts together, but comparatively easy to weld a steel piece to a cast iron piece.

The advantage of electric welding is that the work can be done without preheating the parts and without removing the parts from the ship (provided the electric arc can be properly directed along the fracture).

Mr. D. W. Wilson, Jr., vice-president of the Wilson Welder and Metals Company, Inc., of New York, gave his personal attention and supervision to the work of welding.

Repairs to the Armenia

The first vessel upon which this method of repair was tried was the *Armenia*. The cylinders were removed from the ship to the dock, although this was unnecessary. The welders were put at work welding two nozzles on the main cylinders. This particular piece of work is interesting because when finished no calking was necessary on these welds. When the first test was made some leakage developed in the weld and it was found that, due to the position of the cylinder, the welders had difficulty in reaching the points to be welded, and the work was not properly done. When the cylinders were turned over so that the operator could get at the work easily the weld was very soon completed and a test of 75 percent above the working pressure showed no signs of leakage of any description. The vessel was very quickly placed in service at a cost for this particular part of the work of about one-fourth of what had been anticipated.

The next vessel—the *Nassovia*—had almost a similar job—that is, two steam nozzles to be welded. On this work an air calking tool was used to calk the whole surface of the weld. From that time on no weld was considered satisfactory until it had been thoroughly gone over by the calking tool. It was found that on laying on the welding metal it might be porous in spots, but in addition to the necessity of closing up the porous spots the

* From the Journal of the American Society of Naval Engineers.

hammering of these welds is sure to develop any hard or brittle metal; and where any such does develop, that part of the weld is immediately cut out and new welding metal laid on. The writer believes it *essential for safety* that no weld, whether done by the electric process or by oxy-

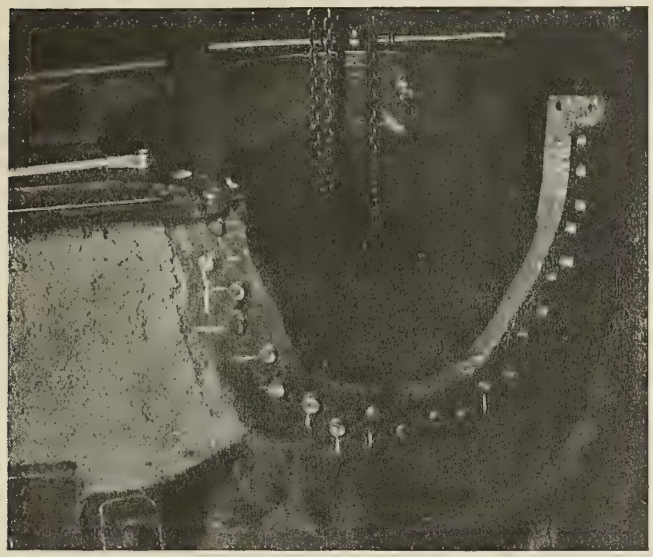


Fig. 1.—*Prinzess Irene*, Damaged High-Pressure Cylinder, Ready for Insert, Preparatory to Welding

acetylene, can be considered safe for such work until it has been hammered and the weld proved in that manner.

The *Pisa* was next welded, this being another case of welding main engine nozzles. One of the effects of the skepticism of engineers with regard to this work was shown when the *Pisa* sailed from this port to Norfolk and, on arrival at Norfolk, it was reported that the weld had given way. Investigation demonstrated that two small pin holes had shown up in the weld, from which oozed an occasional drop of water, no steam issuing whatever, but there had been so much talk of the dangers of the electric welding that the engineers of the vessel were afraid to go to sea with it. It was only after the naval engineers from the Norfolk Navy Yard had pronounced the work safe that the engineers of the ship were prevailed upon to make the voyage.

Damage to S. S. Prinzess Irene

The *Prinzess Irene* and the *Frederic der Grosse* were sent to the Navy Yard, Brooklyn, N. Y., for overhauling. The breaks shown on these engines were probably as difficult of repair as any. These two vessels have been completed and are now in the transport service. From the start no trouble has ever developed with regard to the welds after they were pronounced finished. Some of these photographs show the break after being prepared for welding; others show the cylinder with the insert fitted ready for welding, and others show the completed weld. It will be noted that the cast iron side is studded. This is not done as a necessary part of this repair, as all tests of welds made by the welding apparatus have shown practically the same tensile strength as the material which was welded. This laying over of metal on the cast iron side of the weld was merely done as a precaution and to increase the strength of the weld beyond that of the rest of the cylinder.

The welding done on the *Frederic der Grosse* and the *Prinzess Irene* is the first straight electric welding in any of these vessels. In all previous cases the skepticism of the engineers who had immediate control of deciding upon the form of patches which should be used caused them to have patches cast overlapping the cylinder walls and there bolted to the walls, so that part of the pressure was taken by the bolts and not all of it by the weld, as is the case of the *Frederic der Grosse* and the *Prinzess Irene*.

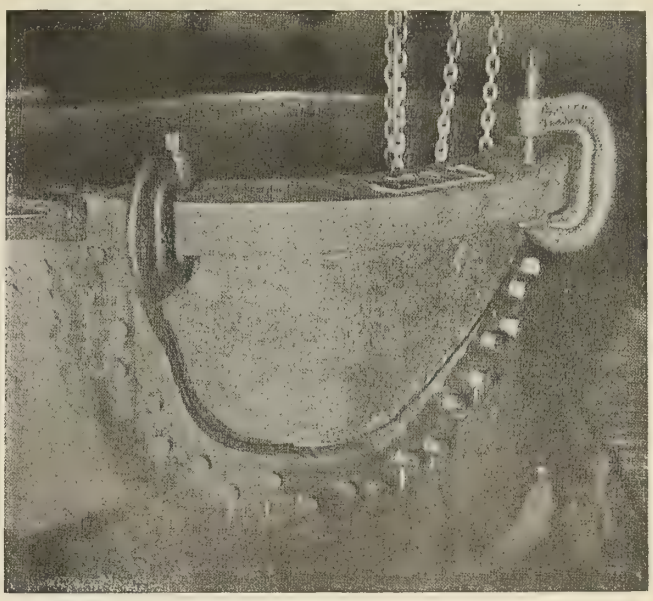


Fig. 2.—Same as Fig. 1, Insert in Place Ready to Weld

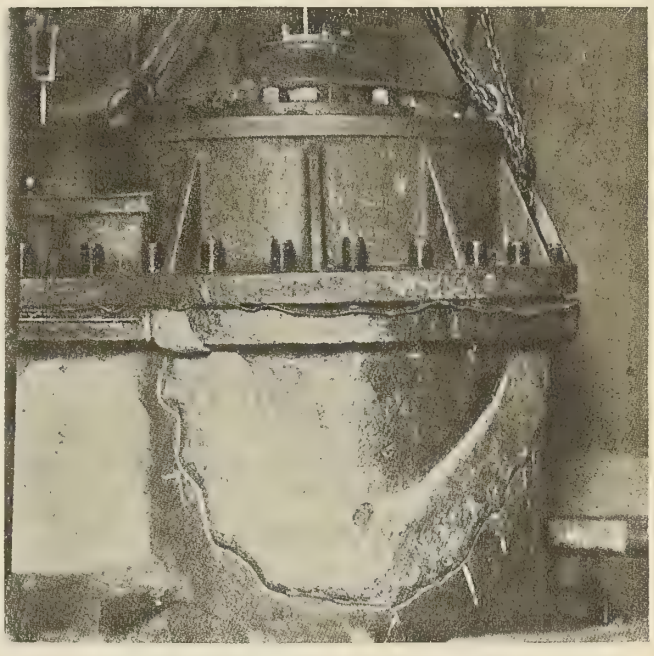


Fig. 3.—Same as Fig. 1, Finished Weld

On the *Koenig Wilhelm II* the original intention was to repair the cylinders by mechanical patches. These patches were made of composition and in most cases were in the form of inserts between cast iron sides of the breaks. When these vessels were taken over by the Navy Department all composition patches were discarded and cast steel patches substituted, but, due to the fact that the cylinders had already been tapped for the bolts of these mechanical patches, the cast steel patches were bolted to the cylinders and then welded. The amount of fitting necessary to make a mechanical patch steam tight is shown by the fact ten weeks after the *Koenig Wilhelm II* repairs had started the machinists were still at work on these patches

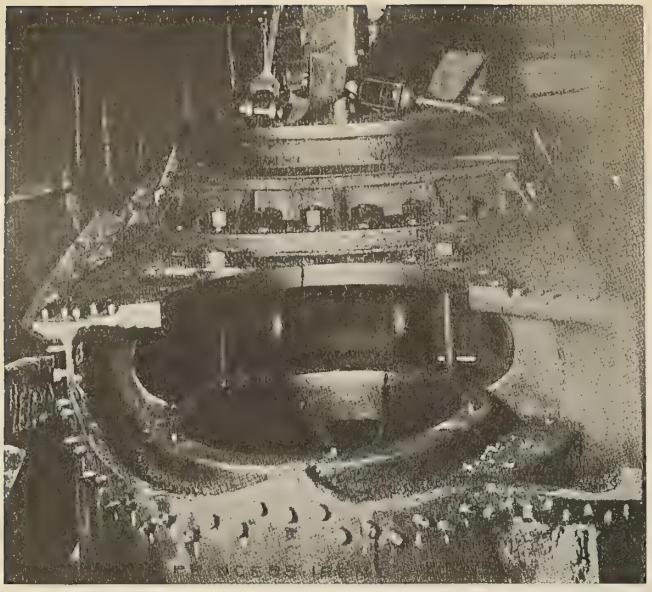


Fig. 4.—*Prinzess Irene*, Damaged Intermediate Pressure Valve Chest, Ready for Insert, Preparatory to Welding

scraping them to a fit. The difference between this method and that of welding steel patches is shown by the fact that many of the patches on the *Frederic der Grosse* and the *Prinzess Irene* were fitted in 48 hours ready for welding. In other words, they are not fitted at all, but merely beveled off to receive the welding material.

On the *Kaiser Wilhelm II* a slightly different condition was encountered, in that the liners for the cylinders in some cases had pieces broken out of them. In the case of the low pressure liners it was decided that the small area covered by the break did not justify the condemning of these liners. Therefore cast iron inserts were made and welded in place and then ground down to the surface of the rest of the liner. New liners were cast for the high pressure cylinders.

Bent Rods, Broken Pistons, Etc.

Besides the damage to the cylinders and valve chests there were some cases of bent piston rods, broken pistons, broken cylinder covers, and various other smaller items of destruction. On the *Kaiser Wilhelm II* the intermediate piston rod on each engine was badly bent, but not so badly as to preclude its being straightened and replaced. This work is now completed.

In no cases were the boilers of these vessels maliciously injured, and in very few cases were the major auxiliaries tampered with. From the methods used in disabling the machinery it would appear that the Germans had a definite plan in view, and it is very probable that all parts broken have duplicates already cast and ready in Germany to replace them at the end of the war. In a number of the ships the engines were disabled by breaking or throwing overboard the throttle valve. The procuring of new throttle valves has generally taken as much time as the repairs of the breaks to the machinery.

Case of the Vaterland

The case of the *Vaterland* is quite different from that of any other of the ships. The *Vaterland,* being the largest ship afloat and the most complicated, seems to have had inferior engineering talent operating it. Her engines are of the Parsons type of turbine, there being four ahead and four astern turbines on four shafts. All the ahead engines were found in excellent condition, and all of the

Fig. 5.—Same as Fig. 4, Insert in Place, Ready to Weld

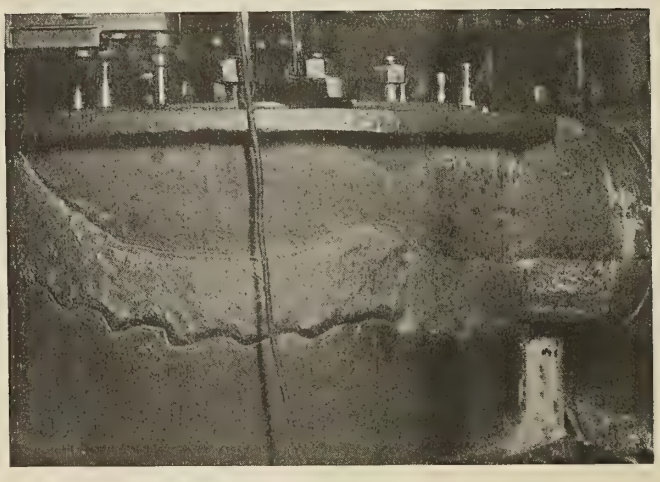


Fig. 6.—Same as Fig. 4, Finished Weld

astern engines were found more or less damaged. The major part of this damage seems to have been due to faulty operation and not to any malicious intent. Cracks were found in the casing of the starboard high pressure backing turbine. These were so extensive that it was palpable that the engines had not been used on the last run. This view has been corroborated since by the discovery of certain written matter on board showing that the vessel made the last trip on three propellers and at reduced speed. One crack in the lower casing of this turbine extended a distance of about 8 feet around the circumference of the steam belt. Other cracks were found in the upper half of the casing. In addition to this the dummy cylinder was found cracked in three places, all being in the wake of the nozzle box. This turbine has one stage of impulse blading, and, as the action of the nozzle boxes had evidently been such as to distort the casing and develop the cracks which were found, it was decided to cut off the impulse blading entirely. While this will reduce the economy in these engines, it is not believed that it will reduce the backing power to any extent, since more steam will be admitted to the reaction blades than formerly.

The auxiliaries of the *Vaterland* were in fair condition, as were the boilers. The vessel has 46 Yarrow boilers with closed ash-pit system of forced draft. The boilers showed evidence of poor handling. The presence of a great amount of oil shows poor marine practice, and it appears that the Germans were using lubricant in the cylinders of the auxiliaries. This practice has been discontinued in our service for many years. It is a curious

fact that, although this vessel had steam lines which in some cases extend over a length of 300 feet, she was not fitted with proper drains and traps, such drains as were fitted being run into the bilges. The boilers are not fitted with internal feed pipes, and as a result they seem to prime very easily. Internal feed pipes have been fitted.

Holes Bored in Suction Pipe

Besides the damage to the blading of the backing turbines a few minor attempts at disabling the ship were discovered. One section of suction pipe to the fire and bilge pumps was found with holes bored in it, these holes plugged up with putty and red lead and then covered so that they would not be discovered. The glands for the stern-tube stuffing box had been removed and strewn through the bilges. A great deal of water had entered the stern-tube compartment. All parts of these glands were located and replaced and the compartments cleared of water.

One of the great difficulties in carrying on the repair work of these vessels has been the lack of proper drawings and the lack of information with regard to the operation of the machinery. This has been particularly true in the case of the *Vaterland,* on account of the great mass of machinery and electrical apparatus and piping, and it has been only by the most patient and dogged following up of pipe lines and electric wiring that sufficient knowledge of this vessel has been acquired to render it safe to take it to sea.

In summing up the subject it is thought necessary to invite particular attention to the following items with regard to electric welding and its proper application. In welding cast iron it is particularly essential that the welding metal be laid on the cast iron surface with the greatest care, since it is the juncture between the cast iron and the welding metal which is liable to be inferior. To accomplish this the welding metal should be laid over the cast iron surface wherever possible before the patches are put in place. This method gives the welder more room to work and permits him to keep a steadier arc and thus reduce the probability of too much or too little heat spoiling that part of the weld. This metal as it is laid on the cast iron surface must then be peened by a calking tool in order to develop any hard spots or spots where contact is not good. After this part of the operation is completed the patches should be put in place, and the completion of the weld then is merely welding of steel to steel, which is a very simple process.

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Skilled Welders Necessary

Of course, it is important in such special work as this that the operators be the most skillful obtainable. In the work which has been carried on in the German ships the operators have not been particularly skilled men in all cases on account of the great number necessary and the comparatively few who are fairly skilled in this art. For that reason more cutting out and replacing of bad metal has been necessary than would have been the case if the

Fig. 7.—Damage to *Pommern's* Boilers

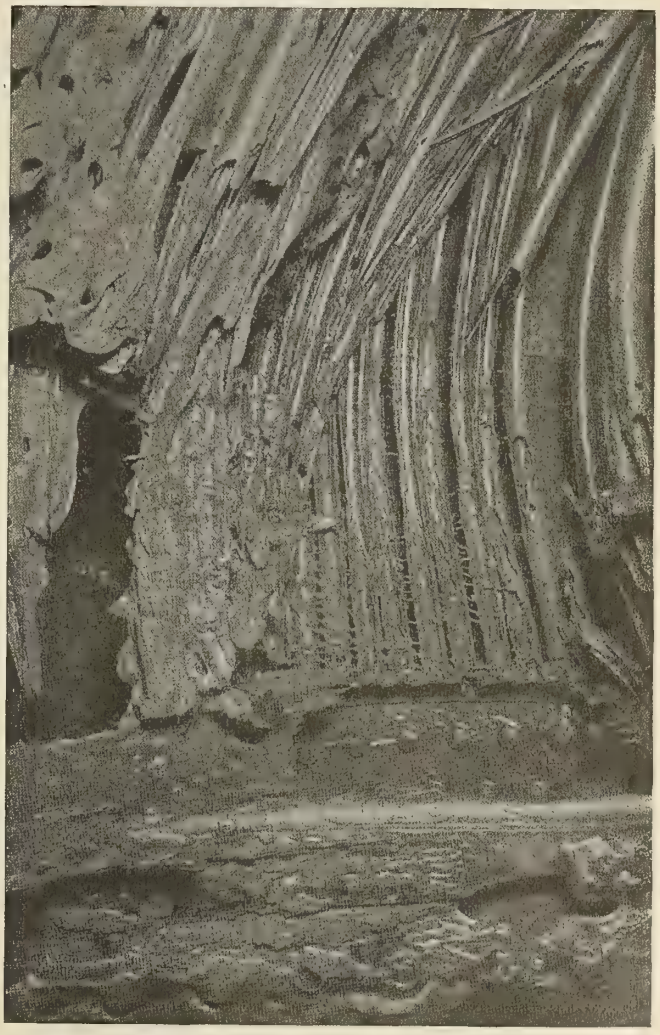

Fig. 8.—Damage to *Pommern's* Boilers

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Fig. 9.—Patch Clamped in Place for Welding

work had not been so extensive and had only skilled operators been used.

It is thought to be a remarkable fact that in all the work which has been undertaken by the electric welders there has never been a failure; this in face of the fact that almost every conceivable kind of patch has been handled, and also in face of the fact that the work has been very much more extensive than any ever before attempted. I believe this is practically the first of its kind of any moment to be attempted in marine engineering. The writer's confirmed belief is that the scraping of cast iron parts of machinery is entirely unnecessary and will very soon be a thing of the past. It cannot be too strongly insisted that in every case in which this method has been used the repaired job has been fully as strong as it was before the damage was committed, and in most cases stronger in the particular part affected.

The following information regarding damaged German vessels interned in other American ports is also reproduced from the same issue of the *Journal of the American Society of Naval Engineers:*

Boiler Damage on S. S. Pommern

The S. S. *Pommern,* now the *Rappahannock,* was interned at San Francisco. When it was decided to put her in service a survey of the vessel developed the fact that of four Scotch boilers on the vessel but one could be repaired. It was necessary to renew the other three.

The accompanying photographs give some idea of the nature of the damage. The boilers were ruined by dry firing. Not satisfied with the results of this treatment, it appears that thermit or some kindred agent was employed to complete the vandalism.

The net result, however, was negligible. Considering, quite aside from the cash value, the military value of the vessel, for every ship to-day has at least a potential military value, the cost and time required to effect the necessary boiler repairs and replacement would surprise the agents that so carefully thought out the campaign of vandalism on the German vessels seized in this country.

When the *Neckar, Rhein* and *Bulgaria* were turned over to the Norfolk Navy Yard for repairs their main engine cylinders had been badly damaged by the German crews just prior to seizure of the ships by the United States Government. The ships are all twin screw and equipped with quadruple-expansion engines of the usual marine type. Of the 24 cylinders on the three ships, 17 were damaged. Of this number 15 required welding. This applies to the cylinders proper. In addition, there were several broken fittings and cracked cylinder liners. In the course of repairs the only casting which was made complete was one low pressure valve chest cover, which was so badly broken as not to warrant repair.

Repairs to S. S. Bulgaria

On the *Bulgaria* the two high pressure cylinders were damaged by having the flange to the main steam inlet nozzle broken. These two cylinders were repaired by machining off the broken flanges and threading the nozzles with a fine thread for about 2 inches. Steel plate flanges were turned, threaded and fitted to the nozzles. No welding was performed on these two cylinders, and the job tested satisfactorily.

In none of the acetylene welds did any leaks, other than one or two pin holes, show. In the arc welds leaks of various sizes developed in practically all welds, and were closed by rewelding or calking. The large weld in the *Bulgaria,* for example, was tested four times before passed as tight. In every case the leak was between the welded metal and the cast iron cylinder wall. No leaks showed where the welded metal joined the cast steel patch.

In preparing the cylinders for either arc or acetylene welding the jagged edge of the break was first smoothed off and then beveled to approximately 45 degrees; wooden patterns representing the patch were then fitted to the break in the cylinder and a cast iron or steel patch made from this pattern. The cast iron or cast steel patch, after cleaning, was fitted to the cylinder and beveled to approximately 45 degrees on the welding edge. The patch was then clamped in place for welding.

When arc welding was to be used all cast iron edges adjacent to the weld were drilled and tapped for ½-inch studs spaced about 1½ inches center to center. Two rows of studs, staggered, were employed. The theory of using steel studs is that the weld will take hold of the studs without fail and thus assure a good hold on the cast iron. Studs were, of course, not fitted when acetylene welding was used.

With the patch secured in place the arc welding proceeded by first building up the edges of the V slot from one end to the other and then filling in between these steel-

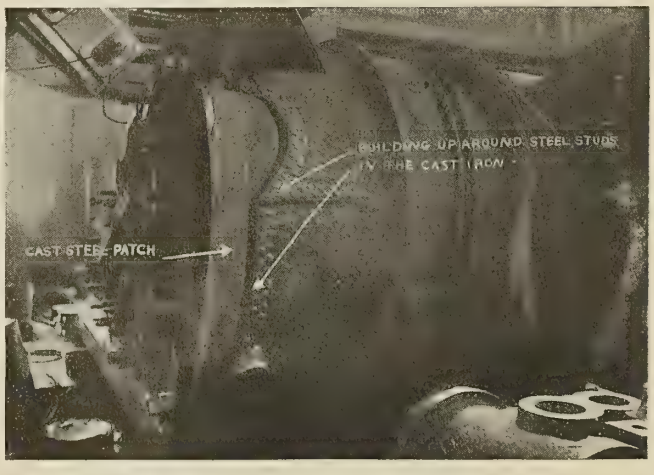


Fig. 10.—Metal Built Up Around Studs

plated surfaces with the welding material. At no time during the weld was the adjacent metal allowed to become very hot. Overheating induces shrinkage or cooling strains in the weld. These are particularly noticeable where the weld joins the cast iron. The welding material is steel wire for all arc welds.

Acetylene welding is fundamentally different in application, and, while in arc welding every effort is made to keep the vicinity of the weld cool, in acetylene welding preheating is employed and the actual filling of the V slot is done in lengths of about six inches. The sides of the slot are actually fused with the torch and small pieces of welding rod and flux added to the puddled metal. Having built up 6 inches flush, another section of the same length is then fused and filled. On heavy cast iron the weld proceeds at about eight inches per hour. By skillful manipulation of the torch and the use of flux most of the slag and other impurities are worked out of the weld. Cast iron welding sticks are used for filling in.

In order to prevent after-cooling cracks in the metal near the weld it is necessary, in acetylene welding large bodies, to employ preheating. This is most satisfactorily done with a charcoal fire built under the break. In most of the cylinders this was started about four hours before the welding. The fire is kept going all the time during the welding and is allowed to die out in place when the weld is finished. In fact, when finished, the weld, fire and all, is covered up and slow cooling encouraged.

Another point required in acetylene welding is that due to the fluid condition of the metal when the torch is applied it is necessary to keep the surface of the metal horizontal. In a cylinder, therefore, when the break is circumferential, it is necessary to mount the cylinder on rockers or, in some other convenient way, make it possible to rotate it as the weld proceeds.

As the foregoing brief description is primarily to illustrate the actual welds and not to go into the relative merits of the two methods of welding, no further discussion on that point is offered. The most important conclusion is that complicated breaks in fifteen cylinders, besides many lesser parts, were successfully repaired, and that to-day three valuable ships are in service against a country that strove in vain to render these ships useless for months.

Lifesaving Equipment for Uncle Sam's Fleet*

First Class Lifeboats and Operating Gear Must Be Provided to Meet Submarine Hazard—Motor Lifeboats Advocated

BY CAPTAIN A. P. LUNDIN

MANY landlubbers have a theory that "sailors," from captains to deck-hands, can be turned out as fast as hot cakes, or, in other words, that men to run a ship can be trained like chauffeurs to run an automobile.

Any man who has had experience in navigating knows that it takes more than theoretical knowledge. I had opportunity to meet with many young men who came with fine diplomas as graduates from schools of navigation; but when it came to finding out where the ship was, one of them once had her in the middle of China when we were only a few miles from the California coast!

Besides the actual science of navigation, we must also consider the importance of good judgment at sea and when approaching land, particularly in thick or rough weather. Of course, soundings are made with the line, but a good sailor must rely a good deal on his nose and eyes. That so-called sea-sense of an old tar is not learned in a school. It can only be acquired in years of actual experience at sea.

And what is true of the chart-room and forecastle also applies to the engine room, where it is sometimes a case of keeping up steam and the engine running even with a leak in the steam pipe and hot bearings in the engine.

Besides, there are many engineers who may be very experienced and capable on land, but at sea they are likely to become seasick unless they are properly accustomed and trained to the sea. Seasick engineers, navigators and sailors cannot be depended on in an emergency.

Although we may build a merchant marine in short order we cannot train our officers and men and make them physically and mentally fit to meet all emergencies with the same record speed, so it is more important than ever to take due precautions as to the lifeboat and floatage equipment in order that as many as possible of our valuable trained officers and seamen may be saved to serve their country further. The same holds true of our soldiers on the transports, and the knowledge that our boys are provided with the very best safety appliances for use in case of disaster would be very reassuring.

Now, as to what constitutes the best floatage and lifeboat equipment, this is rather a broad subject and must be taken seriously.

When it comes to saving lives, the best equipment is none too good, and results from observing the policy of "*getting the cheapest*" are often disastrous. The safety of all on board does not depend on the lifeboats alone, but on the chocking and stowing, the davits, the releasing gears—in fact, on the merits and efficiency of even the smallest detail of the equipment, and last, but not least, on the drills, which should be carried out frequently and under conditions as nearly as possible like those which obtain in case of accidents at sea, so that sailors and soldiers, as well as passengers, may grow accustomed to the handling of lifesaving apparatus under strain of excitement.

I need hardly say that I consider mechanical davits a necessity; this necessity has been recognized in the rulings made by the International Conference on Safety at Sea some years ago. And it must be a mechanical davit that permits of swinging out the boats loaded, keeps them under control at all times during launching, and, above all, with sufficient power so that the boats on the high side of

* From an address before Marine Section of American Society of Automotive Engineers, New York, January, 1918.

the ship, in case of a list, will not be useless. Moreover, it must be simple to operate and have no intricate parts that can be put out of business by weather conditions at sea.

The chocking is also very important, and even seconds count when it comes to releasing the boats in time of danger. Before the war, when passenger traffic was heavy, our ocean liners had to carry "boats for all," and to save deck space the so-called pontoon boats, built of flimsy material, were stowed under the regular lifeboats. But this type of boat is not strong enough to support the open boats without extra heavy shocks, made up with the help of beams, stanchions, bolts, etc. Of course, it takes a long time to release such boats, and even at best they are not very reliable for lifesaving.

Light Rafts Preferred to Folding Boats

I much prefer a light raft to these folding contraptions of easily deteriorating material, for the former can be easily thrown overboard if it comes to the worst, and will serve as an emergency support for those who are swimming or floating about with only a life preserver to save them from drowning.

The most important of all modern improvements in the field of lifesaving equipment is the motor lifeboat. A couple of years ago a new law was passed requiring all passenger ships under the American flag to be equipped with at least one power lifeboat. In my estimation, it is just as important that every cargo ship should be equipped with one likewise. At that time there was a difference of opinion among captains, navigators and seamen generally as to the value of a power lifeboat.

The reason for this may be sought in human conservativeness when it comes to new things. In this respect the sailor is apt to be as cautious as the landsman.

Ideal Motor Lifeboat

An ideal motor lifeboat should be so constructed that it can be launched under davits and also without davits, or, in other words, in a case where the ship sinks quickly, the crew can get right into the boat, and when the ship goes down the motor boat will take care of itself. Being built of steel with very large, thick Balsa wood fenders on the outside, it cannot be crushed in, and, having a beam of at least one-third of the actual length and a great deal of excess buoyancy, it cannot be swamped or capsized, and even if it should turn over—which might occur if it were hit by a spar or smokestack with tremendous force—it would soon right itself.

In such a lifeboat the power plant becomes of extreme importance, for the reason that in order to make such a boat efficient it will necessarily become somewhat large and heavy, and it would be almost impossible to handle such a boat with oars in a heavy seaway. Besides, by having power such a boat will become more or less a mother-ship to the other lifeboats, and they can be towed and kept together instead of drifting apart and getting lost.

Such a power boat can carry more food and provisions than the other boats, and help them out, and when the weather is stormy and cold the people in a housed motor boat will be protected against the sufferings of exposure to wind and sea.

The motor lifeboat does not have to be a boat of high speed, and in choosing the engine I advocate the heavy-duty type, which is always more reliable. The engine should be well protected in a separate steel trunk, so as to insure against engine trouble owing to the effects of salt water. The propeller should also be protected, preferably in a tunnel, so that it will not easily get bent or twisted out of shape, as when the boat is being launched or floated off. I consider this very important, even to the extent of sacrificing a little speed.

For the average freight ship I would recommend a boat 28 to 30 feet long, which in most cases would take care of the entire crew. Let us take, for instance, a 28-foot boat for the smaller freighters. This would have a capacity of forty to fifty persons, and in emergencies could take care of double the number. Its fuel capacity is about 150 gallons. Figuring on a 24-horsepower, heavy-duty engine, this would carry it about 300 miles at an approximate speed of six or seven miles per hour. The total weight of such a boat would be about 9,000 pounds, and considering that we have davited boats of 50 to 60 tons, without trouble, this could be readily taken care of as far as launching is concerned.

Of course, such boats are somewhat expensive compared to the ordinary lifeboat; but even if such a boat costs a few thousand dollars, what does it matter if by its use a few more lives can be saved? *Actual lifesaving should be the prime consideration to those entrusted with the equipment of our ships.*

Safety the First Consideration

Everybody in the country realizes the importance of ships, more ships and still more ships, but very few think of the safety end, apart from the ships themselves—except those who have to man them. If they had their say they would not hesitate to demand the best that can be obtained. They realize that we are at war. War at sea is worse, if anything, than on land, and we need every precaution that can be taken.

It is strange that, although insurance companies and underwriters keep a very accurate record of improvements in fire-extinguishing apparatus, pumps, boilers, engines, etc., just as architects and fire underwriters for buildings have a most explicit rating on fire protection, elevator systems, etc., yet the former are concerned only with the cargo of ships and the saving of property, whereas very little attention is paid to the kind or quality of lifesaving equipment that is carried on the ships with a view to safeguarding the crew.

Considering the fact that our Government is now taking the lead in underwriting the ships and lives that cross the war zones, I think it would be well for everybody responsible and concerned with the matter to do their bit towards avoiding loss of life and set premiums in accordance with equipment. Now is the time, if ever, to protect and shield those valuable men who have to go through years of training, and the shield we hold over them should be made up of wisdom on the one side and virtue on the other. Wisdom is knowing what to do next, and virtue is doing it.

A cool drink for the fireman gives better results than a hot cussing.

Give the men in the boiler room all the fresh air possible. It is good for them and the fire.

When something happens in a boiler which no one can explain, it is poor policy to say it is a mystery and let it go at that. Find out the reason or you may become one who has solved the oldest of all mysteries. The notice may read, "Please omit flowers."

Fig. 1.—Row of Four-Room Houses for Shipyard Workers

Gulf Coast Shipyard Solves Housing Problem

**Model Village Built by International Ship Building Company—
Hotel and Workmen's Cottages Designed Along Homelike Lines**

WHERE a pine forest stood six months ago a model village is to-day being established at the side of the plant of the International Ship Building Company, one mile from Pascagoula, Miss. Landscape artists, engineers and architects have contributed their talent toward the most attractive and practicable arrangement of streets and dwellings. Modern municipal improvements, electric lights, water and sewerage are being installed. A natural park near the center of the town will be further beautified with plants and shrubbery. An amusement and recreation hall, with reading and billiard rooms, shower baths and other conveniences and comforts, will be provided. Workmen's cottages, three, four and five rooms in size, of which there will be 300, a number already completed and occupied, are designed along artistic and homelike lines. Each house is made to differ somewhat in exterior appearance. A two-story hotel is about ready for the accommodation of officials of the company; workmen without families and visitors. An experienced man will be employed permanently to see that streets and lawns are kept in good condition.

Well-Housed Workmen More Efficient

Both practical and altruistic motives have inspired the company in undertaking a housing plan of such magnitude.

"Aside from its purely industrial features," says H. H. Roof, general manager, "a shipbuilding plant such as ours is primarily a human institute, an organization made up of a number of men, an aggregation of individuals affected by good or evil influence that reflect themselves in the general morale of the force and its efficiency or inefficiency.

"It therefore follows that whatever is good for the individual must necessarily be good for a collection of individuals, for a company or a corporation.

"We are looking after the welfare of our men, first, because it is our duty as employers of labor to see that our

Fig. 2.—Hotel Built for Accommodation of Shipyard Workers

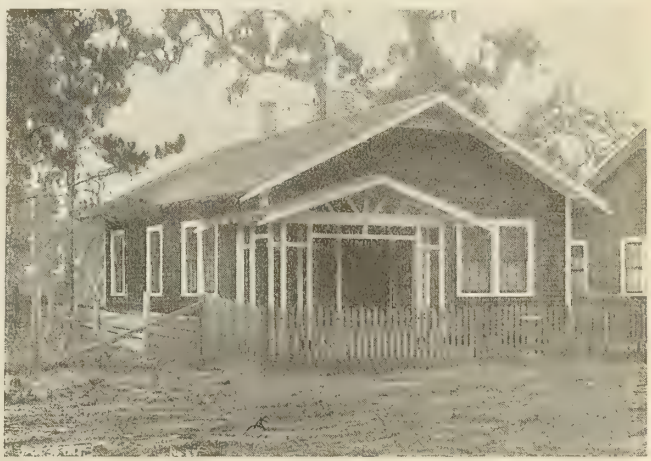


Fig. 3.—Popular Type of Workman's House. Designs Varied to Suit Taste

employees are provided with clean, comfortable, wholesome surroundings; that they are furnished recreation and amusement of the proper kind for their idle hours; that they are afforded every opportunity for the full development of the best that is in them. A man worth anything at all is worth taking care of.

"The well-housed, contented workman is more efficient than his ill-cared-for brother, and, even though nothing else were taken into consideration, it is my belief that from the standpoint purely of dollars and cents it is the best sort of investment that any company could make to invest in satisfied and loyal employees.

"An employer will be very shortsighted if he fails to also realize that we are approaching the time when there will be a serious labor shortage in the United States. And labor is going to stay with the man and the company which appreciates the service of the good workman and takes a genuine, sincere interest in his welfare."

Housing Investment Nets Company Good Revenue

The four-room California bungalow type appears to be the house in greatest demand among the shipyard workmen. This cottage consists of kitchen, dining room, living room and bedroom, with bathroom and pantry off kitchen (rooms about 12 feet by 14 feet), fireplace and mantel; front and rear porches, electric lights and water connections. Owing to the comparative cheapness of Southern pine lumber and its ready availability in large quantities, this type of house can be built for about $600 (£123). The house rents for $3 (12/6) a week, or $156 (£32) a year, 26 percent of the original outlay, exclusive of cost of ground, which is small.

A somewhat more pretentious structure is the standard five-room house, papered and weatherboarded, the cost of which is between $1,100 (£225) and $1,200 (£246). This house rents for $16 (3/6/8) a month. It has the same conveniences as that mentioned above, and in addition two fireplaces, or, where fireplaces are not provided, facilities for four stoves. The rooms are 13 feet by 14 feet.

The three-room house is built along simpler lines, and is not equipped with bathroom.

All houses are placed sufficiently far back from the street to allow space for front lawn, and each has a garden plot in the rear, with shed.

The real showplace of the village is the hotel, two stories high, the exterior of the first floor being stained up in California bungalow style, the second story weatherboarded. The hotel has 52 bedrooms, in addition to lobby, dining room, kitchen and bathroom. There are two big granite fireplaces, one in the lobby, the other in the dining room. The lobby and dining room are beamed, with panel wainscoting up about five feet. All bedrooms except two have outside exposure, with at least two windows each. The rooms are ceiled and painted, with electric lights and wall switch in every room.

Plans for any of the above houses and hotel may be obtained from the Southern Pine Association, New Orleans, La.

New Wooden Shipyard Started in Quebec

Ideal Location for Building Wooden Ships Found at Three Rivers—First Keels Laid in Zero Weather

THE Three Rivers Shipyards, Ltd., of Three Rivers, Quebec, Canada, was organized in the summer of 1917 by T. M. Kirkwood, of Toronto, president and general manager, and William T. Donnelly, of New York, vice-president and consulting engineer, after a very careful and thorough investigation of the possibilities of developing wooden shipbuilding in Eastern Canada as a permanent industry.

The city of Three Rivers is located at the outlet of Lake St. Peter, on the St. Lawrence River, about half way between Montreal and Quebec, and this location has many remarkable natural advantages for shipbuilding, including the following:

A natural deep water harbor, without dredging or artificial work of any kind.

Less difference in water level either from tidal or flood causes than any other location in Canada; an extreme of 4 feet and a usual variation of about 2 feet. This small variation is of the utmost importance in relation to the launching of vessels and their protection from flood while under construction.

A careful investigation of the labor conditions in and about Three Rivers convinced those interested in the enterprise that the sturdy Canadian woodsmen of the past still made his home in and about Three Rivers, and that his far-famed skill with the axe was not a thing of the past.

A careful survey of the adjacent region to the north of Three Rivers, extending up to the new trans-continental line, made certain that there was in Eastern Canada a large and dependable supply of native wood suitable for the

Fig. 1.—General View of Three Rivers Shipyard from Waterfront

Fig. 2.—Erection of Plant Begun

Fig 3.—Building Ways

building of wooden ships of the larger size for a period of many years.

Finally, the city of Three Rivers has one of the best and most dependable sources of electric power available anywhere, and there is to be found in this city a combination of industries which, taken together, will support and aid a shipbuilding industry.

As a final consideration, those having the enterprise at heart received a most thorough and hearty welcome and support from the mayor and officials of Three Rivers.

A contract was received from the Imperial Munitions Board for two wooden vessels of 2,700 tons deadweight. The keels for these vessels were laid on November 3, and the first frame put up on December 21. In spite of the most severe weather Canada has known in more than a generation, the work proceeded in the open without interruption, and on January 26 hull No. 1 had 43 frames erected, and hull No. 2 26 frames.

Credit for this excellent progress is due to the hearty and loyal French-Canadian woodmen of Eastern Canada, backed up by a thoroughly modern and complete mechanical equipment, protected by a building constructed to meet the severe climatic conditions of Eastern Canada. Within this building, which is 168 feet by 75 feet and thoroughly steam heated, all machine and tool work proceeds without interruption during the most severe weather. A mold loft 168 feet by 50 feet gives ample room for laying down lines and taking off forms. All tools are operated by individual electric motors of ample capacity. A separate building houses an electrically driven air compressor of ample capacity.

To properly care for its staff of workmen, this company

Fig. 4.—Work Continued in Zero Weather

Fig. 5.—French-Canadian Woodmen Make Excellent Shipbuilders

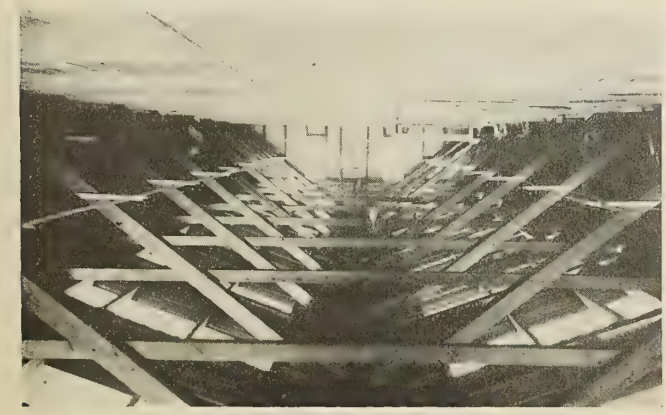


Fig. 6.—Interior of Mold Loft

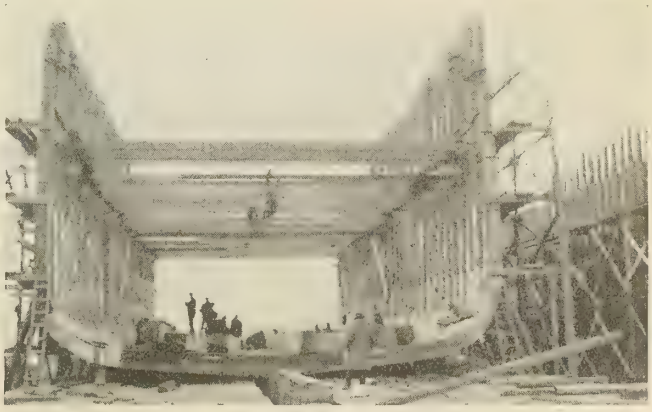


Fig. 7.—First Vessels in Frame

has provided a bunk house 50 feet by 25 feet, thoroughly heated, where the men can spend their lunch hour under homelike conditions. As a further recognition for good service rendered, the company has replaced the familiar water-pail and dipper by hot coffee served the men at work twice a day.

While the company have made a start with only two vessels, it is developing a staff of workmen so rapidly that other keels will be laid as soon as the Northern winter begins to lessen its severity, and there is every reason to believe that the foundations of a permanent and successful wooden shipbuilding industry have been laid at Three Rivers.

This company has acquired all the rights for the Province of Quebec, under patents granted to William T. Donnelly, of New York, for dry docks, new method of wooden ship construction and other marine devices, and Mr. Donnelly is to act as vice-president and consulting engineer for the company, with a New York office at 17 Battery Place.

Preventing Waste of Coal in Boilers*

Alternative Methods of Eliminating Losses Due to Inefficient Operating Management—Educational Plan Advocated

BY DAVID MOFFAT MYERS

WHILE organized effort to bring about efficiency in the production and distribution of coal is being made, no parallel measures have been adopted to bring about a normal and practicable efficiency in its use. The hundreds of large plants which are consuming fuel wastefully, in many cases more wastefully and carelessly than ever before, are directly and needlessly causing a large fraction of the existing car shortage. They are overloading the already strained capacity of the railroads; they are rendering slower and more difficult the transportation of food and other vital commodities, and, in short, they are simply counteracting the measures of efficiency in production and distribution which have elsewhere been established.

Preventable Waste of Fuel

The preventable waste of fuel in the boiler furnace of one steel mill amounted to 40,000 tons per year, which at $5.00 (1/0/10) a ton would cost $200,000 (£41,000). This was a comparatively modern plant. The efficiency of boilers and furnaces in a 14-day test was 55 percent. The load factor was unusually favorable to high efficiency and could readily be raised to 70 percent or over. This is only one example, and there are many more extreme cases. In one hand-fired plant the evaporation was raised from 6 to 9 pounds in a few days of instruction, and continuously kept close to this higher mark with the help of coal and water measurements which were inaugurated. The saving was due exclusively to instruction and consequent better operation.

The saving or wasting of one-fourth of the coal consumption of any industrial plant depends entirely upon the efficiency of its operating management. Let me emphasize that this fraction of the consumption relates exclusively to the boiler plants; i. e., the production of steam; and does not include the large economies possible in connection with its distribution and use.

For well-known reasons the boiler plant offers the more lucrative field for producing economies, and these with a minimum of alteration in physical equipment.

Under present conditions a plant which carelessly operates at an efficiency of 40 to 50 percent receives from the Government the same consideration in the delivery of coal as the one whose efficiency is 70 to 75 percent. This obviously is unfair as well as wasteful.

The Government hands over, say, 200,000 tons of coal a year to a plant owner, but asks for no account as regards its consumption, nor any questions as to the amount of steam it is made to produce. There is nevertheless an equivalent amount of steam this fuel is capable of generating, and it can and should be made to produce that quantity.

Conservation Methods

In general, there are two plans of operation worthy at least of consideration. One might be termed the autocratic method. This would involve the use of authority to compel coal consumers to execute such measures of economy as the proper authorities might prescribe for any given case. Limits to be set as to expense to the user. Such limits might be in terms of a percentage of their present yearly coal bill. Alterations to be directed chiefly, as previously implied, to purely operating improvements. Many objections would probably be made by consumers against this plan, but once in effect the majority would no doubt realize its pecuniary advantage to themselves. But its tendency may be too strongly opposed to democratic principles.

The other plan would be largely an educational one, in which patriotism and efficiency would furnish the motive forces required.

The teaching must be accomplished with the utmost simplicity and directness. Above all, it must be in such form as to be readily comprehended and applied. This is a big task, but with the technical and executive ability represented in this society these things should be, and can be, accomplished.

The requisite information must reach the owners and managers of industries, and there must be simple instruction sheets for the engineers and firemen. The vital importance of daily accurate records of coal and water must be taught and information given regarding practical appliances for automatic measurements of both.

Blank forms might be sent in advance to plant owners in order to be advised by them, first, whether they would be willing to co-operate with a governmental organization offering to assist them in reducing their coal consumption,

* From a paper on "Preventable Waste of Coal in the United States," read before the American Society of Mechanical Engineers, New York, December, 1917.

and second, to obtain such data as to size, type, equipment, operation and fuel consumption of the plants as would enable a classification which would permit a Government board of experts to send such instructions as would include the information needed for any one class of plants.

This work would be greatly aided by a staff of experts ready to visit plants when so requested by owners and make investigations and recommendations and keep in touch with the progress of economies. Included in such a staff should be men intimately familiar with practical operating economies, whose duties would be the delivering of lectures or talks, which should be planned so as to reach directly not only managers and owners of the industries, but also the chief engineers and firemen of the boiler plants. This feature of the plan, by itself, would undoubtedly result in great savings.

The U. S. Bureau of Mines has for a number of years engaged in obtaining and disseminating scientific information regarding the mining and consumption of coal, and the results of the work have been of great value to technical engineers who are able to use and apply it. It is evident that we now require an extension of the idea of education, but in such form as directly to affect the men who run the boiler plants of our country, for in their hands is the saving or wasting of one-fourth of our fuel supply.

Six hundred million tons of coal were mined in the United States in 1916. If we assume only one-half of this to have been used for our industrial boiler plants, then a quarter of the coal used under boilers amounts to 75,000,000 tons per year. It is worth while to save this fuel by preventing its waste. This quantity of coal represents the use of 1,500,000 fifty-ton freight cars.

Remarkable Growth of Isherwood System of Ship Construction

IN spite of the practical abolition of shipbuilding for private ownership, the Isherwood system of construction has made marked progress during the past year. No less than 180 vessels, aggregating in deadweight carrying capacity about 1,334,000 tons, have been ordered to be built on this system since the end of 1916. The grand total since 1907 now stands at 800 vessels, aggregating 6,000,000 tons deadweight carrying capacity. The following statistics show the remarkable progress which this system has made in the comparatively short period of ten years:

			Tons Deadweight Carrying Capacity
Sept., 1907, to Dec., 1908....	6	ships, aggregating	31,608
1909.....	36	" "	212,992
1910.....	76	" "	484,752
1911.....	140	" "	958,795
1912.....	240	" "	1,777,348
1913.....	270	" "	1,993,034
1914.....	311	" "	2,351,322
1915.....	468	" "	3,548,221
1916.....	620	" "	4,666,000
1917.....	800	" "	6,000,000

While the Isherwood system has been adopted almost universally for oil tank steamers, and to a very large extent in the case of general cargo vessels, it is eminently suitable and advantageous for all types of boats, as is evidenced by the following analysis of the 800 craft referred to above:

			Tons Deadweight Carrying Capacity
General cargo vessels, colliers and ore steamers and passenger vessels.....	386,	aggregating	2,891,600
Great lake freighters.....	24	"	279,600
Oil tank steamers.....	310	"	2,800,000
Barges	77	"	26,800
Dredgers, gross register tons.....	2	"	760
Trawler, gross register tons.....	1	"	570

In great Britain and Japan the growth of the system still goes on with great rapidity.

Producer Gas Plant Proves Economical on Harbor Work Boat

OPERATING on less than 1 pound of coal per horsepower per hour, the 65-foot motor boat *Isaac Fass* is proving one of the most economical motor boats operating in Chesapeake Bay and its tributaries. The vessel has a capacity of carrying 1,500 bushels of oysters and is equipped with a 90-horsepower gas engine manufactured by the Rathbun-Jones Engineering Company, Toledo, Ohio, which operates on producer gas furnished by a 100-horsepower gas producer manufactured by the Nelson

Motorboat *Isaac Fass* Operates on Producer Gas

Blower & Furnace Company, Boston, Mass. The boat has a speed of 12 miles per hour and uses on an average 75 pounds of coal per hour at full speed.

The engine is air started, and when put in operation the plant is automatic except for charging the producer with a small amount of coal from time to time and taking out a small amount of ash. The cost of operating this plant is equivalent to using gasolene (petrol) at 2 cents (0/1) per gallon, or steam coal at $1.25 (5/2½) per ton. The engine requires less than half the amount of lubrication required by engines using gasolene (petrol), kerosene (paraffin) or other liquid fuels. The insurance rates are one-third less than for a gasolene (petrol) boat.

To put the plant in operation the time required is from 10 to 20 minutes, depending upon the length of time the plant has been standing-by and the amount of draft left on the producer. Although the engineer of the *Isaac Fass* had had no previous experience with producer gas plants, he has encountered no difficulties in operating the plant, and says he prefers the producer gas plant to a gasolene (petrol) or heavy oil engine.

A dirty or ill-kept fire room generally means a poor fireman.

When your water gets low do not try to pump it up too quickly, especially if the feed water is cold. Better yet, do not let your water get cold.

When you slice or haul your fire shut the door into the engine room. The dust of ashes is about as bad as emery on the moving parts of machinery.

Letters from Marine Engineers

Discussion of the Designs and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs,

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

Repairs to Evaporator Ram Pump

While running at sea our evaporator pump broke, as shown in Fig. 1. As a quick repair was necessary, it was carried out as follows:

A piece of pipe was selected, filed smooth and made to fit the gland and neck bush. An ordinary collar was screwed to the top of same and drilled to suit the crosshead pin. It was also cut out to form the jaws. Two short

Fig. 1

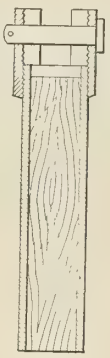


Fig. 2

pieces of pipe were used to make up the distance from the inside of the collar to the width of the connecting rod head. The pipe was then plugged with wood, which swelled out, making a good job.

The pump, as repaired, carried through a voyage of twenty days and was still good when taken out for permanent repairs.

San Francisco, Cal. A. B. Blundun.

Marking Tools

Often the marine engineer and machinist gather during their cruises a number of personal tools, such as calipers, micrometers, wire gages, steel squares, scales, etc., to aid them in their work. Many ships have well-stocked tool lockers, but in spite of that, lots of the boys like their own personal tools, and each one, of course, wants to mark his name or initials on these to avoid mixing them up with the ship's tools and to provide a means of recognizing them.

For the accurate and delicate tools, the name must be etched into them with acids, for the use of steel name stamps would ruin them. The formula given below has been successfully used by a number of friends for this work.

One ounce of common salt; one ounce of copper sulphate; one-fourth ounce of alum sulphate; one-half ounce of zinc sulphate; four ounces of distilled water. These chemicals are well mixed and put into a bottle, then shaken until well dissolved.

The tools are polished clean and bright at the part to be marked, and then this place is smeared with good soap or covered with beeswax thick enough to scribe the name in with a tool scriber. After the name is clearly inscribed, shake the mixture well again and pour into the tracing enough to fill it well; let it soak until the name turns to a copper color; then moisten the soap with water and clean it off. The owner's name is then indisputably imbedded on his tools in his own handwriting.

A. Tool.

Handy Rigging Helps

The various hooks and devices shown in the sketches of this article are almost indispensable for use on board ship in the various classes of engine and machinery overhaul work, for rigging the differential or chain falls, and for

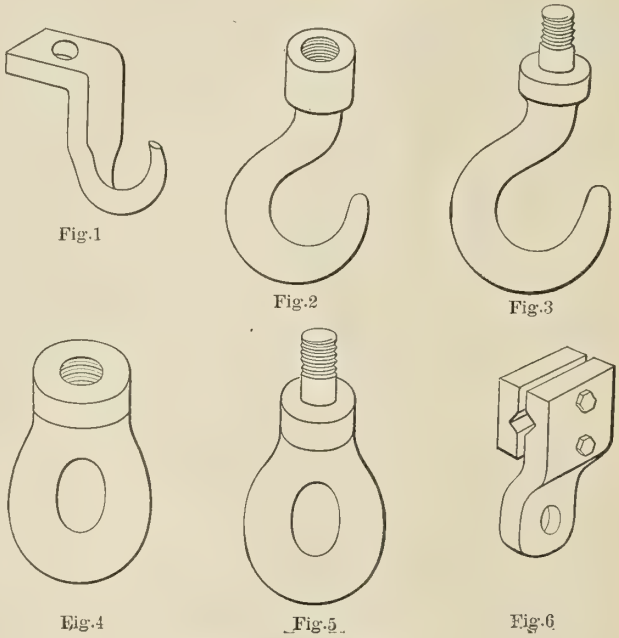


Fig.1 Fig.2 Fig.3

Fig.4 Fig.5 Fig.6

Hooks and Eye Bolts

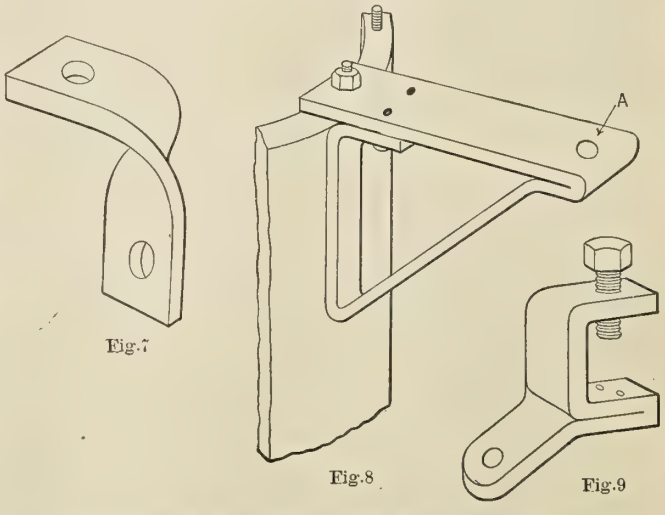


Fig.7 Fig.8 Fig.9

Right Angle Strap, Chain Fall Bracket and Clamp

lifting. They are all home-made products that can be easily made by the ship's blacksmiths and machinists.

Fig. 1 represents an angle hook; Fig. 2, a female hook; Fig. 3, a male hook; Fig. 4, a female eye nut; Fig. 5, a male eye bolt; Fig. 6, a beam clamp; Fig. 7, a right angle strap; Fig. 8, a cylinder wall chain fall bracket, the hole at *A* receiving the hook of the falls. Fig. 9 shows a very rugged type of clamp made from ¾ by 1½-inch flat stock, bent as shown. The lower jaw is riveted at *A*. The hole in the ear *B* is for the chain fall hook. This is an original idea with the writer and it has served him very well. Having made the clamp in various heavy sizes, it permitted the easy rigging of the chain falls in places previously difficult.

Fig. 10 shows the first appearance of the forging for making the clevis strap, Fig. 11, and the eye strap, Fig. 12.

Fig. 13 is a common long eye bolt and a tapered bushing. This is useful for easy self-centering of the bolt in holes

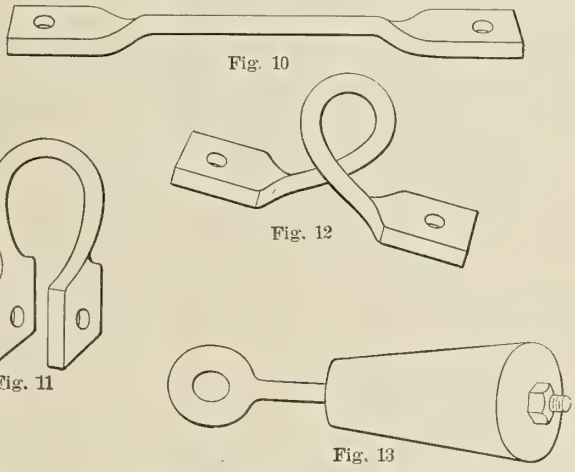


Fig. 10

Fig. 12

Fig. 11

Fig. 13

Clevis Strap and Eye Strap

too large for it and avoids the use of washers. We use it in the stuffing boxes when working on a large job of overhaul.

When an engineer has an assortment of such tools as these, his labor is lightened and shortened to a great extent. Ring bolts, steel rings, cable slings, straps, washers and a plentiful supply of bolts and nuts make his rigging outfit complete, and the work of slinging and lifting of everything from the crank brasses and connecting rod to the thrust block becomes easy.

Directions as to the making of these tools seems unnecessary, since the sketches are quite plain, and the knack all lies in the forging and machining.

Concord, N. H. C. H. Willey.

Oil Can Kinks

Often when oiling some moving rocker arm or like part of an engine, one sticks the snout of the oil can into the oil hole and it becomes jammed or bent. This is because the tip or snout goes into the hole too far.

If a small metal washer is soldered on the spout as shown at *A*, Fig. 1, this will prevent such trouble.

By soldering a piece of stiff brass wire to the end of the oil can spout, as shown in Fig. 2, the oiling of parts out of ordinary reach and accessibility is made easy. The oil will impinge and run down the wire.

Often after considerable use the spring bottom of the oil can becomes lifeless and deflected upward, rendering the can quite useless. When this occurs, just try the kink shown in Fig. 3. Take a hardwood stick or bit of round brass stock that will enter in the mouth of the can, and round up its top. Place in the vise, and put the can on it

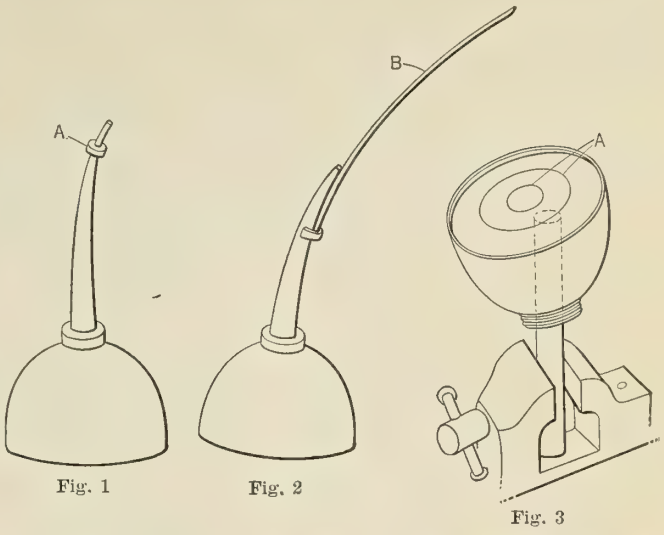


Fig. 1 Fig. 2 Fig. 3

as shown. Now, by applying a slight pressure and revolving the can around alternately on the circles, *A*, many times, the bottom becomes depressed again and new temper or life is found to be given the bottom. Oiler.

Two Lathe Kinks

These two kinks are quite simple and are taken from my notebook to be passed along to the fellow who likes to spend some of his odd time in the ship's machine shop making things that are useful.

Fig. 1 is called a lathe dog wrench plate. It is made out of a piece of ½-inch boiler plate. The tapered slot

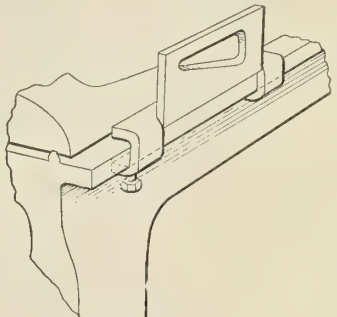


FIG. 1. LATHE DOG WRENCH PLATE

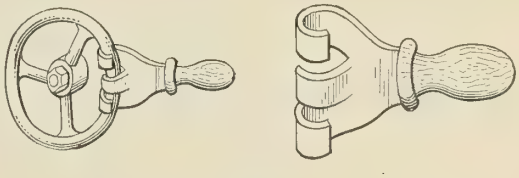


FIG. 2

Spanner

is made of suitable dimensions to take the range of sizes of set screws of the shop's lathe dogs. The plate is cut and bent as shown, and the two jaws are drilled and tapped for the securing screws.

The use of the plate is quite simple. The set screw

of the dog is placed in the tapered slot and forced up to the small end till it is gripped tight, and then the dog is unscrewed or tightened, as desired.

Often when chucking out or drilling a piece of work the continuous hand strain of feeding the tailstock center by the small hand wheel becomes tiresome, and the usual stunt to give more leverage is to apply a monkey wrench. While this serves the purpose, it mars or nicks up the wheel, and then again there is not always a wrench handy.

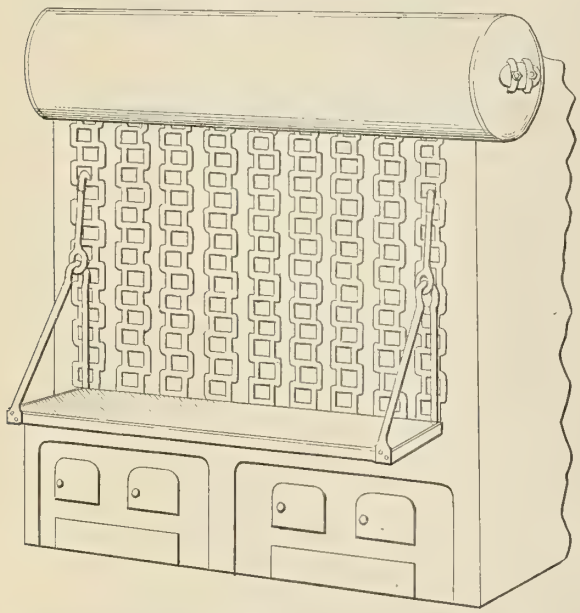
Fig. 2 shows a small spanner made from ¼-inch plate steel, one end being bent to grip the wheel, as shown, and the other end cut to a tang shaped like a file, and on this a wooden file handle is driven. The spanner is short enough to clear the latheways, yet gives sufficient leverage for easy applying of the drill pressure by the tail stock center.

MARINE ENGINEER.

Boiler Cleaning Platform

The sketch shows a very handy portable boiler cleaning platform that we have used for the tube cleaning work of our Babcock & Wilcox boilers.

The framework consists of 1½-inch angle iron. Into this are laid 2-inch planks. The hangers or brackets are



Portable Platform for Use in Cleaning Boiler Tubes

of ¾-inch round iron. These are bent to the shape shown and the hooks are made to hang over the edge of the upper manhole, as indicated. These hooks are covered with brass pipe to protect the edge of the handhole.

A platform like this is adjustable to the various heights by shifting the hooks to the higher or lower handholes.

FIREMAN.

Forced Lubrication on a Thrust Block

The value of a continuous flow of lubricating oil to a bearing is, of course, well known, but too often not realized. On a suction dredge which the writer had to do with some little time ago there were twin centrifugal dredging pumps with impellers of the open type, driven by a pair of compound engines.

The job was practically new; but the pump thrusts gave trouble from the start and heated to such an extent that it was necessary to put the water service on. The thrust shoes were solid, with babbitt on each side, and the water simply sprayed on them. A plentiful supply of water kept the temperature down and enabled the job to run; but as the water was loaded with sand, it soon made a sad mess of the babbitt and the thrust collars, which were forged solid with the shaft.

The case was considered carefully, and the conclusion come to was that the thrust load was excessive; that is, it was more than could be taken care of by the means of lubrication provided. Continued use of the water service would put the shaft on the scrap pile in a few months. It was therefore decided to fit the thrusts up with forced lubrication.

The troughs under the thrust shafts were tapped and piped to a tank located as low in the ship as possible. The tank was made of galvanized iron, and was provided with a strainer and a cooling coil of pipe, through which sea water circulated. It is quite possible that this coil could have been dispensed with; but this was not known at the time of installation. The strained oil compartment of the tank was connected to a 3-inch by 2-inch by 3-inch duplex pump, which discharged directly to the thrust shoes. The connection was made by tapping out the original oil holes. As the thrust was always in one direction, one pipe to each shoe was sufficient. Small cocks on each pipe provided a means of regulation, which could be observed by the amount of oil welling up between the shoes and the collars. An additional strainer, made by securing several disks of gauze in a large union located in the discharge to each thrust, caught all the fine particles of fluff, etc., which would otherwise have choked the oil ways in the shoes.

The pressure under which the oil was delivered was not ascertained; but it was not likely more than about 20 pounds per square inch.

That the investment was a good one is proved by the fact that it is now some years since the job was done, and there has been practically no wear, although for part of that time the dredge was running eighteen hours per day. Of course, it was necessary when doing the job to true up the shaft collars and rebabbitt the shoes, the babbitt in the latter being heavily charged with sand picked up from the water.

N. Vancouver, B. C. A. F. MENZIES,
Mechanical Engineer.

Why He Wasn't Promoted

He wasn't promoted, for he was content
To be second rate—not at all diligent—
Lacked heart in his work—watched the clock very close—
Grumbled continually, and was too morose—
Was always behind hand, and tried to make bluff
Take place of ability—then get in a huff
If the boss called him down for what he deserved—
At the least opposition he'd get all unnerved.

He had no ideal, nor had he pluck—
Success he attributed to just plain luck.
Sometime he may wake up and then realize
That success can never be won as a prize;
He'll have to use energy, strength and will power,
And to make wisest use of each fleeting hour;
Stop dreaming—start doing—and then make his chance—
For that is the only sure way to advance.

Concord, N. H. C. H. WILLEY.

Put your oil holes in the center and not at the ends of your bearing. If they are already there plug them up and drill holes in the center.

Precaution Against Fire on a Diesel-Engined Ship

In a paper recently presented before the United States Naval Institute by Ensign Z. W. Wickes, U. S. N., describing the loss of the British motor vessel *Sebastian,* which was burned on May 8, 1917, while en route from New York to Rouen and Havre, France, with a cargo of petrolite, some valuable suggestions are made as to means for preventing such a fire on similar vessels.

The *Sebastian* was a tank motor vessel owned by Lane & MacAndrew, of London. The vessel was heavily laden and her only reserve buoyancy was located in the forward trimming tanks and ship's hold and in the engine room and after trimming tank. In the large engine room aft were located the propelling machinery, consisting of a Werkspoor Diesel engine, auxiliaries and two boilers, one above the other, for auxiliary use. Coal bunkers containing 50 tons of coal were located outboard of the boilers on both sides of the ship. Forward of the engine room was the main fuel oil tank, about 10 feet long, which occupied the full cross-section of the ship. Between the fuel oil tank and the after cargo hold was interposed a 4-foot cofferdam. There were located in the engine room two ready fuel oil tanks, holding about 5 tons of oil, which were filled daily. The overflow of these tanks was on the engine room floor plates, and no filling safety devices were installed. The engine room watch consisted of two engineers and an oiler.

The ready fuel oil tanks were being filled in the first dog watch, and by some undetermined cause overflowed. The oil spread over the engine room floor plates into the bilges and came in contact with the hot exhaust piping of the main engine. This ignited the oil, the flames spread rapidly and drove the watch out of the engine room immediately. The fire spread into the ready fuel oil tanks and the coal bunkers, the doors of which were open. The engineers' living quarters, which were located alongside the engine room hatch, were soon afire. The woodwork on the poop caught fire from there and the whole stern of the ship became very quickly a mass of flame. The intense heat of the burning oil and coal buckled the decks and sides of the ship and started the seams and rivets to such an extent as to allow water to pass into the engine room. The forward bulkhead of the engine room was affected in the same manner. As the fuel oil seeped through it caught fire, and the after side of the bulkhead became a sheet of flame.

The oil in the main fuel oil tank became dangerously heated, and several spontaneous combustions of the gas at the top of the tank took place on the afternoon of the second day. The covers of the two large hatches in the top of the tank, on the after well deck, were removed and sea water was pumped in by means of a handy-billy. After the oil had been somewhat cooled in this manner, the suction of the handy-billy was placed in the tank and the mixture of oil and salt water pumped overboard. More water was pumped in from time to time in an attempt to save the forward bulkhead of the engine room, which was becoming red hot. In this manner, after about twelve hours, the fire was extinguished. By the time the fire was put out, so that access could be had to the engine room, the ship was settling by the stern and heavy seas were breaking over the poop. The cargo was protected by the cofferdam, which was flooded by means of sea valves soon after the fire started.

The sketch of the course of the fire and brief outline of the location of the compartments in the after part of the ship led to proposed alterations in the design and equipment of the vessel which might prove of value in preventing a recurrence of such an accident on similar ships. The alterations are elementary and will require very little time or expense to make.

Undoubtedly the first and most important change must be made on the ready fuel oil tanks. A warning device to operate when the tank is 95 percent full and an automatic closing valve to close immediately afterwards could be installed in a very short time. These devices are already in use on larger tanks. The overflow pipe should be fitted, in case the above devices fail to operate. However, it should discharge in some place in plain view of the engineer on watch and where there would be no danger of the oil coming in contact with the hot piping.

The ship was not provided with any fire-fighting apparatus. It seems very pertinent that a vessel built to use heavy oil engines should be equipped with some form of a sand blast which could be operated from the upper gratings of the engine room. An oxygen helmet for use by the man operating the sand blast would be very valuable and necessary.

The two boilers for auxiliary purposes were situated on platforms, one above the other, in the after end of the engine room, as were the coal bunkers, so that all of the power on the ship was put out of commission by a fire in one compartment. The boilers should be placed in a compartment entirely separate from the engine room. No hand pumps were carried on the ship. Handy-billys, as supplied to the naval service, are very serviceable. Inasmuch as the engine room compartment was so large and formed practically all the reserve buoyancy aft, it would seem desirable to have a large power pump located in an accessible compartment, separate from the engine room and connected to the bilges of the latter.

In view of the construction of the ship and the location of the main fuel oil tank a cofferdam similar to the one between it and the after cargo hold could easily be placed betwen the tank and the engine room. Such a cofferdam would have protected the main fuel oil tank and the fire would have burned out in a few hours without the loss of the ship.

NEW BOOKS

Finding and Stopping Waste in Modern Boiler Rooms. By engineers of the Harrison Safety Boiler Works. Size, 9 by 7 inches. Pages, 276. Illustrations, 213. Philadelphia, 1918: Harrison Safety Boiler Works. Price, $1.

The saving of coal is the purpose of this practical handbook, which is addressed to power plant owners, managers, engineers and firemen. The statements, tables, charts, etc., have been selected as were supported by experiments and tests, references being given wherever possible to the original authorities.

Eye Hazards in Industrial Occupations. By Gordon L. Berry, Field Secretary National Committee for the Prevention of Blindness, with the co-operation of Lieutenant Thomas P. Bradshaw, U. S. Army, formerly technical assistant to the Director of the American Museum of Safety. Pages, 150. Numerous illustrations. New York, 1918: National Committee for the Prevention of Blindness, 130 East Twenty-second street. Price, 50 cents.

In this volume the author reviews the chief industrial hazards to eyesight in the industries of the United States. Case reports illustrate each section, the special dangers are described and recommendations made for such changes of working conditions, or installations of protective devices, as have been found suitable for protecting workers. The book is most completely illustrated.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding will be Answered in this Department

CONDUCTED BY H. A. EVERETT *

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

There will appear in this column from time to time questions which have been asked by the Board of Steamboat Inspectors in the various examinations for engineers' licenses conducted by them. Such questions will be denoted by an asterisk (*) placed before the number if from examination for grade of chief, and by a dagger (†) if from examination for other grades.

Strength of Solid and Bracket Floors

Q. (950).—Are there any published results of tests on floors made up of solid plates and bracket plates, showing the strength for different combinations of the same weight?

A. (950).—I know of no published results along the line indicated. It is generally accepted that the solid floor combination is preferable for merchant construction, as it is considered to give greater local strength for the same weight, and does not involve the costly construction work of the more continuous longitudinals. The system of complete continuous longitudinals as used in warships is, of course, obsolete for merchant vessels, and even for this system the so-called bracket floors are really solid floors with a central vertical strip cut out, as the earlier type of pure bracket construction has fallen into disfavor.

Horsepower of Engine

Q.* (942).—What is the horsepower of an engine 18 inches diameter of cylinder, 30 inches stroke of piston, 100 revolutions per minute, and 84 pounds mean effective pressure?

A. (942).—

$$I.H.P. = \frac{2PLaN}{33{,}000}$$

P = mean efficiency pressure, pounds per square inch,
L = length of stroke in feet,
a = area of piston in square inches,
N = number of revolutions per minute.

$$a = \frac{\pi \times \overline{18}^2}{4} = 254.5 \text{ square inches}$$

$$I.H.P. = \frac{2 \times 84 \times 2.5 \times 254.5 \times 100}{33{,}000}$$

$$= 324.$$

Twisting Moments on a Crank Shaft

Q. (949).—From page 123 of Reed's "Useful Hints to Sea-Going Engineers" (Fifth Edition), in mentioning some of the many problems that can be worked out from the indicator card diagram, there were included the curves of combined twisting moments on the crank shaft. Will you please explain what is meant by the twisting moments on a crank shaft, and which are these curves on the diagram?

A. (949).—By twisting moment on a crank shaft is meant the moment of the turning force applied at the center of the crank. If in turning a grindstone you exert at right angles to the crank a pull of 16 pounds and the crank is 9 inches or three-fourths of a foot long, you are exerting a twisting moment of $16 \times .75 = 12$ foot pounds on the grindstone shaft. Each cylinder, with its connecting rod and crank, exerts a twisting moment on *its* shaft which varies throughout the revolution. The curve of combined twisting moment is obtained by summing the twisting moments due to each crank taking account of the proper angular distance between it and the reference plane, and thus giving the resulting twisting moment on the shaft aft of the engine. This curve is obtained from the indicator diagram by measuring on it the steam pressures for various points in the stroke. These, multiplied by piston area, give the steam forces acting on the piston. These forces, when corrected for the effect of the reciprocating parts, are transformed into twisting moments and plotted on a separate sheet.

Calculating Evaporation of Water in Boiler

Q. (947).—From Reed's "Useful Hints to Sea-Going Engineers" (Fifth Edition), page 126, the following is taken:

"The following is a method for estimating the feed make-up required: Get the water well up in all the glasses, sufficiently high to last four or five hours without the extra feed being put on; keep the job running in its normal condition, with the steam on all the usual auxiliaries. After running the four hours, or as long as possible, note carefully how far the water has fallen in the glasses and also what the engines have indicated. Then if we take the breadth of the boiler at the average water level and the length, it is a simple matter of arithmetic to find the weight of water which has been lost. This, divided by the number of hours and the indicated horsepower, gives us the feed make-up required per hour per indicated horsepower.

(*a*) Will you please explain the simple matter of arithmetic referred to above, and (*b*) can one find out how much water has been evaporated from a boiler during a given length of time (say one hour) by this means?

A. (947).—(*a*) The method can best be explained by working through a specific case. Assume a Scotch boiler 16 feet 3 inches diameter and 11 feet 6 inches length, both dimensions taken to inside of shell, in which the water level is at the beginning of the run 4 feet down from the top of the boiler. At the end of three hours' running the water level is 4 feet 3 inches from the top of the boiler. The problem then is to find the areas of the two segments of circles, one of which has a height 12 feet 3 inches and the other a height of 12 feet. The difference between these is the net area of head uncovered which, multiplied by the length of the boiler, will give the entire contents lost. Areas of segments are most easily computed from tables issued in practically all handbooks using the table issued in Seaton & Rounthwaite's *Pocket Book of Marine Engineering*, 12th edition, page 547, the areas are:

Segment of 4 feet 3 inches height = 43.05 square feet
Segment of 4 feet 0 inches height = 39.60 square feet
Area of head uncovered = 3.45 square feet
Length = 11 feet 6 inches

Volume = $3.45 \times 11.5 = 39.7$ cubic feet = 297 gallons.

This has been lost in three hours, and assuming the indicated horsepower of the main engine to be 1,500, the makeup feed will be

$$\frac{297}{3 \times 1{,}500} = 0.0659 \text{ gallon per indicated horsepower per hour.}$$

Another though less accurate method, if the change of level is great, is to average the chords across the boiler head, multiply by the height the water has dropped and by the length of the boiler. For the case assumed, the chords

* Professor of Marine Engineering, Post Graduate Department, United States Naval Academy, Annapolis, Md.

across the boiler face corresponding to the water levels at the beginning and end are 14 feet and 14.26 feet. The average is 14.13, the height the water has dropped is 3 inches or .25 feet, the volume is then $14.13 \times .25 \times 11.5 = 40.6$ cubic feet, as against 39.7 cubic feet obtained by the first method.

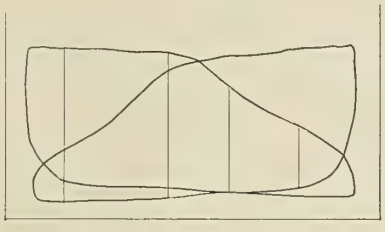
(*b*) No, you cannot find by this procedure the amount of water evaporated from the boiler unless you entirely stop the feed to the boiler during the whole period.

Pressure on Crank Pin and Rotative Effect

Q. (948).—From Reed's "Useful Hints to Sea-Going Engineers," pages 161 and 162, with reference to the influence exercised by the connecting rod over the distribution of pressure on the crank pin, it says as follows: "The advanced study of the indicator card is too much neglected, and the majority of those in charge of engines are very apt to acquire an idea that the indicator card as they see it fresh from the cylinder is a perfect record of the pressure of the steam on the piston, and therefore on the crank pin. A greater mistake than this never existed, because it is quite likely that in a moderately heavy engine of quick piston speed, the greatest pressure on the pin is nearly at the exhausting end of the stroke, especially towards the end of the up-stroke. To such an extent does the connecting rod influence the distribution of pressure, that it is quite safe to assert that if the pressure on the guide does not prove excessive, in a heavy, very quick-running engine, a connecting rod of two and a half or three cranks would give more equal pressure on the crank pin than one of four or five cranks in length. It must be borne carefully in mind that the above refers only to pressure on the pin, not to rotative effort, which to be equal throughout the stroke, requires a heavy pressure, gradually getting lighter and again increasing towards the other end of the stroke. (To illustrate the different effects, an indicator card has been taken to which has been applied the necessary alterations caused by the inertia of the parts, the angularity of the connecting rod, and the gravitation effect of the moving parts, in which card the pressure on the crank pin at each ten degrees travel of the crank are such that when each is multiplied by its leverage, the resulting rotative effort is, excepting for the first and last few degrees, practically uniform for the up-stroke.)"

The above is a little too brief. Will you please illustrate how the connecting rod influences the distribution of pressure on the crank pin; also explain how the different pressures, when multiplied by these leverages, give a resulting rotative effort?

A. (948).—The author apparently means by the "pressure on the pin" that due to the force acting along the connecting rod, but has not clearly differentiated between



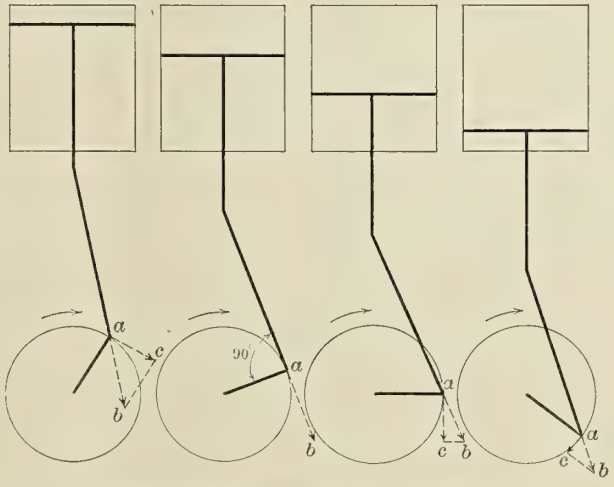


Diagram of Forces on Crank Pin

the part of it due to the steam forces and the part due to the weight and inertia of the reciprocating parts.

For the moment consider only the steam forces which are correctly determined directly from the indicator diagrams by measuring the pressures on the top and bottom of the piston and taking the difference or by measuring the ordinates of the cards, as shown on the figure between the admission and expansion line of one diagram and the exhaust and compression line of the other diagram. These pressures, when multiplied by the area of the piston, give the actual steam forces acting on the piston, and are forces acting in the line of centers. These forces produce forces along the rod which are shown in the diagram for several positions of the piston and connecting rod. This force along the rod is lettered *a-b* in each case. Now, as noted in the previous question, the force which does the useful work of turning the crank is that at right angles to it, so if we break up the force along the rod into its components at right angles to the crank (*ac*) and along the crank (*cb*) the useful force (*ac*) can be found, and this force is the "rotative effect" (uncorrected).

The figure clearly shows that this is a different percentage of the force along the rod dependent upon the angle between the rod and the crank, and is only equal to the force along the rod when, as in the second case, the angle is 90 degrees.

In the figure the force along the rod has been taken as that due to the steam force only, actually owing to the effect of the weight and inertia of the reciprocating parts this is modified, but after its corrections have been added or subtracted, the resulting or true force along the rod is analyzed just as outlined above.

Measuring Angular Advance of Eccentric

Q. (937).—How would you measure the angular advance of an eccentric?

A. (937).—Jack the engine over till the eccentric rod is on its dead center and scratch a line on both the eccentric sheave and strap, then continue jacking the engine till the crank for the same cylinder is on its dead center. The divergence between the scratches on the eccentric and its strap converted into degrees will be the angular advance. The conversion of the measurement along the circumference of the eccentric into degrees of angular advance is probably done most readily by laying it out to scale and measuring the angle as shown. The analytical solution, however, presents no difficulties and is, of course, more accurate. A solution is appended for an assumed case:

Assumptions

Diameter of shaft = 15 inches.
Eccentricity = 3 inches.
Diameter of eccentric sheave = 21 inches.
Divergence of cuts, measured on circumference of eccentric sheave = 7 inches.

Solution

$$\text{Angle } ACB = \frac{7}{\pi D} = 38^\circ\ 18',$$

$$\text{Angle } ACB = 180^\circ - (38^\circ\ 18'),$$
$$= 141^\circ\ 42',$$

$$\frac{BC + CD}{BC - CD} = \frac{\tan \tfrac{1}{2}(CDB + DBC)}{\tan \tfrac{1}{2}(CDB - DBC)},$$

$$\frac{13.5}{7.5} = \frac{\tan \tfrac{1}{2}(38^\circ\ 18')}{\tan \tfrac{1}{2}(CDB - DBC)},$$

Therefore, $CDB - DBC = 23^\circ\ 4'$,
$CDB + DBC = 38^\circ\ 18'$.

$$\text{Angular advance} = CBD = \frac{61^\circ\ 22'}{2}$$
$$= 30^\circ\ 4'.$$

Shipbuilding and General Marine News

Contracts for New Ships—Shipyard Improvements—Engineering Projects—Improved Appliances—Personal Items

HOG ISLAND PLANT UNDER INVESTIGATION

Attorney-General to Investigate Operations of American International Shipbuilding Corporation

Contract with the U. S. Shipping Board Emergency Fleet Corporation May Be Canceled

Disclosures by the Senate Commerce Committee, indicating waste and extravagance in the operations of the American International Corporation, which, though a subsidiary, is constructing the Hog Island shipyard, and has the contract for building 120 vessels at this yard, have led President Wilson to instruct the Attorney-General to thoroughly investigate the operations of the company building this plant.

COMPLAINTS

The complaints against the American International Shipbuilding Corporation are based principally on the following disclosures:

The Government was compelled to pay for the site at Hog Island from $2,000 to $2,500 per acre, whereas a large part of the island had been optioned at $1,000 per acre for a long period immediately prior to its acquisition by the Shipping Board.

The fee of approximately $7,000,000 which the contractors are to receive as their remuneration for organizing and carrying out this work is considered excessive.

Salaries paid to many of the employees are considered excessive, a case in point being a so-called publicity department, the chief of which is paid at the rate of $10,000 a year, while several assistants receive from $6,000 to $7,500 each.

Unnecessary delays and confusion in carrying out the work, due to faulty planning.

Excessive labor expenditures.

"GRAFT" DENIED

In explanation of these alleged conditions, the officials of the American International Corporation deny the existence of any so-called graft in the operations of the company. Although in many cases expenditures have greatly exceeded the estimates originally made, nevertheless it is held that the final results will show that neither the corporation itself nor any of its sub-contractors will make large profits or commissions from the project. On the other hand, the profits will be abnormally small as compared with similar work in civil life.

Officials of the American International Corporation do not hesitate to admit that mistakes have been made, but state that in view of the necessity for haste and explicit orders from the Shipping Board to speed up all operations rather than give first consideration to economy, the results will be justified.

FIFTY SHIPWAYS TO BE BUILT

As a matter of fact, it is now planned to construct the entire fifty shipways originally planned for the yard, and, according to reports from Rear-Admiral F. T. Bowles, who is now supervising the work at the yard for the Emergency Fleet Corporation, the last of the fifty keels will be laid about May 17, if the weather is not too severe.

The contract of the American International Shipbuilding Corporation calls for the delivery of fifty ships by November 1, 1918, and, according to present indications, it seems likely that the ships will be built on schedule. The total contracts now held by the American International Shipbuilding Corporation call for 120 vessels, 50 of which are to be 400 feet long and 7,500 tons deadweight carrying capacity, and 70 vessels 450 feet long of 8,000 tons deadweight.

British Shipbuilding in 1917

According to figures given by Andrew Bonar Law, Chancellor of the Exchequer, in a speech before the House of Commons, British shipyards in 1917 turned out 1,163,474 tons of merchant vessels. In addition to this output, 170,000 tons were purchased from abroad.

During the same year, American shipyards built 901,223 tons of merchant vessels, making a total combined British and American tonnage of 2,064,697 tons, against which some 6,000,000 tons of shipping has been destroyed by the German U-boat warfare.

Shipping Comptroller for New York Appointed

H. H. Raymond, president of the Clyde and Mallory Steamship Lines, was named on January 28 by Chairman E. N. Hurley, of the Shipping Board, comptroller of shipping at the port of New York, with full power to direct the operation of the Board. Mr. Raymond has taken active charge of the affairs of the Division of Operations at New York.

Chief Machinist's Mates Commended for Heroism

Niels Anderson, chief machinist's mate, United States Navy, and Walter D. McLea, chief machinist's mate, National Naval Volunteers, have been commended by the Secretary of the Navy for their heroism on December 17, 1917, when the exhaust lines of the steering engine on the vessel on which they were stationed were carried away by the breaking of the tiller, causing the engine-room to fill with live steam. After three attempts, both of these officers succeeded in entering the steam-filled room and turning off the steam.

WATER TRANSPORTATION INQUIRY

American Coastwise and Inland Waterway Tonnage Decreases

According to a preliminary report just issued by Director Sam. L. Rogers, of the Bureau of the Census, Department of Commerce, and compiled under the supervision of Mr. Eugene F. Hartley, chief statistician in charge of the recent water-transportation inquiry, made as of December 31, 1916, American-owned merchant vessels of five tons net register or over, of all classes, operating during the year 1916 on the coast or inland waters of the United States, including Alaska, or between ports of the United States and foreign countries, numbered 37,894, and had a total gross tonnage of 12,250,000.

The geographical distribution of this gross tonnage was as follows: Atlantic Coast and Gulf of Mexico, 6,509,000; Mississippi River and its tributaries, 1,621,000; Pacific Coast, including Alaska, 1,186,000; Great Lakes and Saint Lawrence River, 2,738,000; canals and other inland waters, 196,000. The distribution, according to methods of propulsion, was: Steam and other power, 6,098,000; sail, 1,089,000; unrigged, 5,063,000.

DECREASE IN TONNAGE SINCE 1906

The increase in number of vessels as compared with 1906 was equal to only 1½ percent, and the gross tonnage shows a decrease amounting to 5 percent. This is accounted for by the marked falling off in number and tonnage of sailing vessels and in tonnage of unrigged craft. The former show a decrease in number from 7,131 to 2,979, or 58 percent, and in gross tonnage from 1,704,000 to 1,089,000, or 36 percent. Unrigged craft, although increasing slightly in number, from 20,263 to 20,334, or four-tenths of 1 percent, show a decrease in tonnage from 7,130,000 to 5,063,000, or 29 percent. On the other hand, craft propelled by steam and other power increased in number from 9,927 to 14,581, or 47 percent, and in tonnage from 4,060,000 to 6,098,000, or 50 percent.

The average tonnage per vessel, for the country as a whole, decreased from 345 in 1906 to 323 in 1916.

The proportional increase during the 10-year period in number of vessels was most pronounced on the Pacific Coast, including Alaska where it amounted to 61 percent; but the greatest rate of increase in tonnage, 34 percent, appears for the Atlantic Coast and the Gulf of Mexico, as against 21 percent for the Pacific Coast, including Alaska. For the Great Lakes and St. Lawrence River the increase in tonnage was 14 percent. On

the other hand, a great decrease in tonnage, from 4,412,000 to 1,621,000, or 63 percent, took place on the Mississippi River and its tributaries; and a decrease of 24 percent appears for canals and other inland waters.

Increases in Value and Business Done

Despite the very small increase in number of vessels and the falling off in total gross tonnage throughout the country as a whole during the ten-year period the figures for value of vessels, gross income, wages paid, and freight carried show marked increases, amounting to 89 percent, 91 percent, 44 percent, and 42 percent, respectively. The number of employes, however, increased by less than 9 percent, and the number of passengers carried shows a decrease of not quite 10 percent. The foregoing items, for the year 1916, are, in round numbers, as follows: Value of vessels, $960,000,000; gross income, $564,000,000; wages paid, $103,000,000; freight carried, including lighterage, or harbor work, 376,000,000 tons of 2,000 pounds; number of employes, 153,000; number of passengers carried, 331,600,000.

The pronounced increase between 1906 and 1916 in freight carried, accompanied as it was by a falling off in gross tonnage, is accounted for by the fact, already pointed out, that the decline in tonnage took place entirely in sail and unrigged craft and was offset in considerable part by a decided increase in tonnage of steam and other mechanically propelled vessels, which, because of their greater speed, are able to carry more freight per annum, in proportion to tonnage, than can be transported by other classes of craft.

The decrease in the number of passengers carried is due to the reduction in ferry traffic resulting from the establishment of the "tube" service in Greater New York.

The vessels operating on the Atlantic Coast and the Gulf of Mexico represented somewhat less than three-fifths of the total number for the United States, a little more than half the total gross tonnage, and about two-thirds the total value, and reported nearly half the total freight carried. The percentages of increase in gross tonnage, value, gross income, and wages paid—34, 130, 136, and 54, respectively—were much greater for these vessels than the corresponding percentages for those operating in other sections of the country. In respect of freight carried, however, the increase for the Atlantic Coast and the Gulf of Mexico was relatively small, being only 29 percent, as against 44 percent for the Mississippi River and its tributaries, 43 percent for the Pacific Coast, including Alaska, and 67 percent for the Great Lakes and St. Lawrence River. Canals and other inland waters, however, show a decrease of 22 percent.

Idle Vessels

The figures above given relate to vessels which were in active operation during all or a part of the year 1916. In addition, the report for 1916 shows 2,681 vessels, with a gross tonnage of 363,000, or less than 3 percent of the total tonnage, as idle during the entire year. The increases in number and tonnage of idle vessels during the 10-year period amounted to 52 percent and 103 percent, respectively. These increases appear for both power and unrigged craft, but a decrease from 565 to 307 is shown for idle sailing vessels, although the tonnage of such vessels increased from 20,000 to 30,600. The proportion which idle tonnage represented of the total shows an increase from 1906 to 1916 for each of the three classes of craft.

Institution of Naval Architects to Hold Annual Meeting

The annual meeting of the Institution of Naval Architects will be held in the hall of the Royal Society of Arts, John street, Adelphi, London, W. C., on March 20 and 21, with the Right Honorable the Earl of Durham, K. G., G. C. V. O., P. S., president, in the chair.

A gold medal will be awarded by the Council to any person, being a member or associate member of the council, who shall at the forthcoming meeting read a paper which, in the judgment of the Council, is deemed to be of exceptional merit. The Council will also offer a premium of books or instruments to the reader of any paper, not being a member or associate member of the Council, which, in the judgment of the Council, merits this distinction.

CONTRACTS FOR NEW SHIPS

The United States Shipping Board, Washington, D. C., has placed contracts during the past few days for 46 steel steamships. It is reported that these ships are all of 10,000 tons each, and that they will cost about $115,000,000.

Horton & Horton, Houston, Tex., have received contracts from the United States Shipping Board to build six 3,000-ton wooden ships.

The Peninsula Shipbuilding Company, Portland, Ore., H. H. Fisher, purchasing agent, has received contracts from the Shipping Board to build eight steamships.

The Coast Shipbuilding Company, Portland, Ore., will make a large addition to its plant. This company has received a contract from the Shipping Board to build ten steamships.

The Chilman Shipbuilding Company, Hoquiam, Wash., has received a contract to build two auxiliary schooners for a French Company.

The Toledo Shipbuilding Company, Toledo, O., A. D. Black, purchasing agent, has a contract from the U. S. Shipping Board to build eight ocean-going steel steamships.

The Albina Engine & Machine Works, Portland, Ore., W. L. Deute, purchasing agent, has a contract from the U. S. Shipping Board to build four steamships.

The Atlantic Corporation, Portsmouth, N. H., which has a contract from the U. S. Shipping Board to build ten steamships, is enlarging its plant, and, according to report, will spend $1,000,000 for new equipment.

The United States Steamship Company, 50 Broad street, New York, which owns the plant of the Groton Iron Works at Groton and Noank, Conn., has organized the Virginia Shipbuilding Company, Alexandria, Va. This latter company has a contract to build twelve steel steamships for the United States Shipping Board.

The Ferro Concrete Shipbuilding Corporation, Redondo Beach, Cal., is reported to have received a contract from the U. S. Shipping Board to build ten 3,500-ton concrete ships.

The Spedden Shipbuilding Company, Baltimore, Md., A. W. Gieske, president, is building a 135-foot steel tug.

The Portland Company, Portland, Me., has received a contract to build a wooden freight steamship for the Great Northern Paper Company.

NEW SHIPYARDS PLANNED

Companies Organized Within the Month for Building Ships

Additions and Improvements to Shipyards in Operation

The Rangeley-Hanson Company, Brooklyn, N. Y., according to report, will build a shipyard at Bay 35th street and Cropsey avenue, Brooklyn. It is reported that the company has contracts to build a number of government vessels. J. S. Glaser is president of the new concern.

The West Harbor Shipbuilding Company is reported to have made plans to build a wooden shipbuilding plant at Boothbay Harbor, Maine.

The Merchant Shipbuilding Corporation, with yards at Bristol, Pa., whose purchasing agent is E. L. Fries, Finance Building, Philadelphia, is planning to build ten new shipways and, in addition, plate shop, machine shop, etc.

The Margaret Ship Company has been incorporated by E. Wrack, J. E. Downes and others, 17 Battery Place, New York.

The Seattle Ship and Construction Company, Seattle, Wash., which has recently been organized, has acquired a site on Lake Washington, where it will build a shipyard.

It is reported that W. H. Gahagan, Rockaway Ave., Brooklyn, N. Y., will build a shipyard at Arverne, L. I., on Jamaica Bay. He is reported to have received a contract to build thirty barges for the U. S. Shipping Board.

Operations are well advanced on the new shipbuilding plant of the Groton Iron Works, near New London, Conn. The ships to be built at this plant will be of the standardized 8,800-ton type.

The Rayburn Lumber Company, Kansas City, Mo., and Apalachicola, Fla., is planning to build a shipyard at Apalachicola.

The Pensacola Marine Construction Company has been organized at Pensacola, Fla. F. W. Blount is president and treasurer.

The Bruce Dry Dock Company, Thomas A. Johnson, purchasing agent, Pensacola, Fla., is planning to build another sectional dry dock and a floating dry dock.

The Acme Scow Corporation, Roslyn, L. I., has been incorporated by P. J. Dobson, J. A. Morden and J. V. A. McCloskey, 64 Wall street, New York, to build a boat works.

The Astoria Boat Works and Marine Equipment Company, 561 Boulevard, Long Island City, N. Y., will enlarge its plant.

Cornelius A. Coe, Hackensack, N. J., and associates, have organized the Ferro Concrete Shipbuilding Company, with a capital stock of $10,000,000.

The Universal Shipbuilding Company, Sturgeon Bay, Wis., has been organized

to take over the plant of Rieboldt, Wolter & Company, Sturgeon Bay. The general manager of the new company is Gustav A. Huck.

It is reported that Norwegian Vice-Consul Belland, Seattle, Wash., with several other Norwegians, plans the establishment of a shipbuilding yard and dry dock at Seattle.

E. J. Adams, Eugene, Ore., is at the head of the syndicate that plans the construction of a shipbuilding plant at Florence, Ore.

Construction work has been started at the plant of the Oceanic Shipbuilding Company, Milwaukee, Ore. This yard will have the capacity to build ten government ships yearly.

Work will be started immediately on the $1,500,000 steel shipbuilding plant to be erected in Vancouver, Wash., by the G. M. Standifer Construction Corporation, J. J. Burke, general manager, Vancouver, Wash.

The Portland Shipbuilding Company, Portland, Ore., has acquired 650 feet of frontage on the Columbia River, where it will build a new plant.

The Williams Shipbuilding Corporation, R. M. Williams, president, Tampa, Fla., has acquired a site of land at Tampa and will build a yard for the construction of steel vessels.

The offices of the purchasing department of the Sun Shipbuilding Company, formerly located at 1428 So. Penn. Square, Philadelphia, Pa., have been removed to Chester, Pa.

The Pensacola Shipbuilding Company, 155 N. Clark street, Chicago, Ill., writes MARINE ENGINEERING, asking that catalogues of firms manufacturing shipbuilding and shipyard machinery be forwarded to them as soon as possible.

One Hundred and Sixty-First Vessel Launched at Davis Shipyard

Early in January of this year the Davis shipyard at Solomons, Md., launched their one hundred and sixty-first vessel, a 1,700-ton coal barge for the Northern Transportation Company. Before the end of the month they had launched another vessel building for the Bethlehem Steel Corporation. This was a tug boat, 133 feet long, equipped with a 1,000-horse power engine.

The Davis shipyard has six building ways and makes a specialty of tugs and barges.

Fig. 2.—View of Davis Shipyard at Solomons, Md., from Waterfront

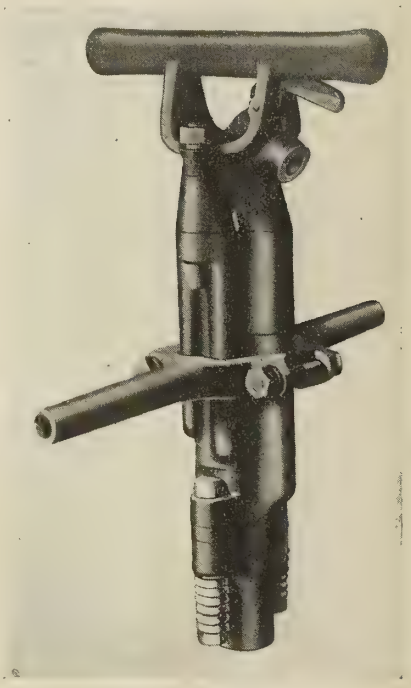
Transatlantic Shipping Under Centralized Control

By the creation of a Ship Control Committee, to have supreme charge of the operation of all ships, American, allied and neutral, entering and leaving American ports, the control of transatlantic shipping has been placed under one head. The Ship Control Committee is composed of P. A. S. Franklin, president of the International Mercantile Marine, chairman; H. H. Raymond, recently appointed comptroller of shipping of New York, and Sir Cunnop Guthrie, who will represent Great Britain, France and Italy.

The arrangement creates a pool of ships moving supplies to Europe. Goods destined for overseas will be loaded in available ships, whether operated by the United States or the Allies. By giving this committee absolute power in the allocation of all tonnage on both sides of the Atlantic, it is believed that the complications and delays which have occurred in handling the United States and allied shipping will be eliminated, and that the efficiency of overseas transportation will be greatly increased.

New Drift Bolt Driver

For driving drift-bolts in ship construction, dock building and similar work, the Ingersoll-Rand Company, New York, has developed and is placing on the market the very powerful pneumatic hammer illustrated. This has been designated Ingersoll-Rand No. CC-25.



Pneumatic Drift Bolt Driver

The machine is of substantial through-bolted construction, has a renewable hammer block bushing and a spring retained front-head to absorb shock. That the machine is built to withstand severe service is evident from the manufacturers' statement that the cylinder, front-head, hammer block, bearing, piston, cylinder cover, bolts and throttle lever are drop forged from special steels and that all wearing parts are given special heat treatments.

The over-all length of the I-R Drift Bolt Driver is 25 inches, its weight 65 pounds. It will drive drift-bolts up to 1½ inches diameter and of 10 foot length. It is normally handled by two men, a second handle being clamped to the center of the tool. An inside trigger controls the operation of the machine and it has been domonstrated that a

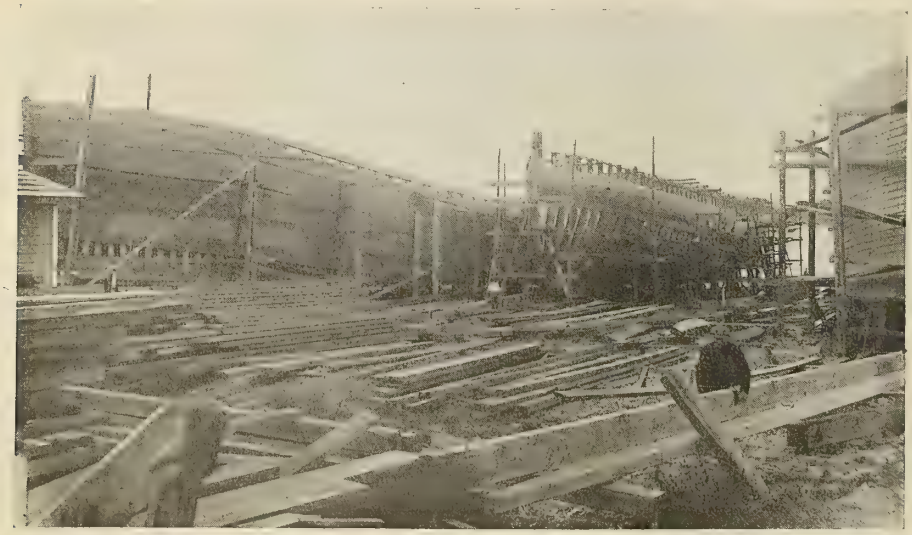


Fig. 1.—Bow View of Tug for Bethlehem Steel Corporation and Two Barges for Northern Transportation Company under Construction at the Davis Shipyard, Solomons, Md.

light or heavy blow can be obtained at the will of the operator.

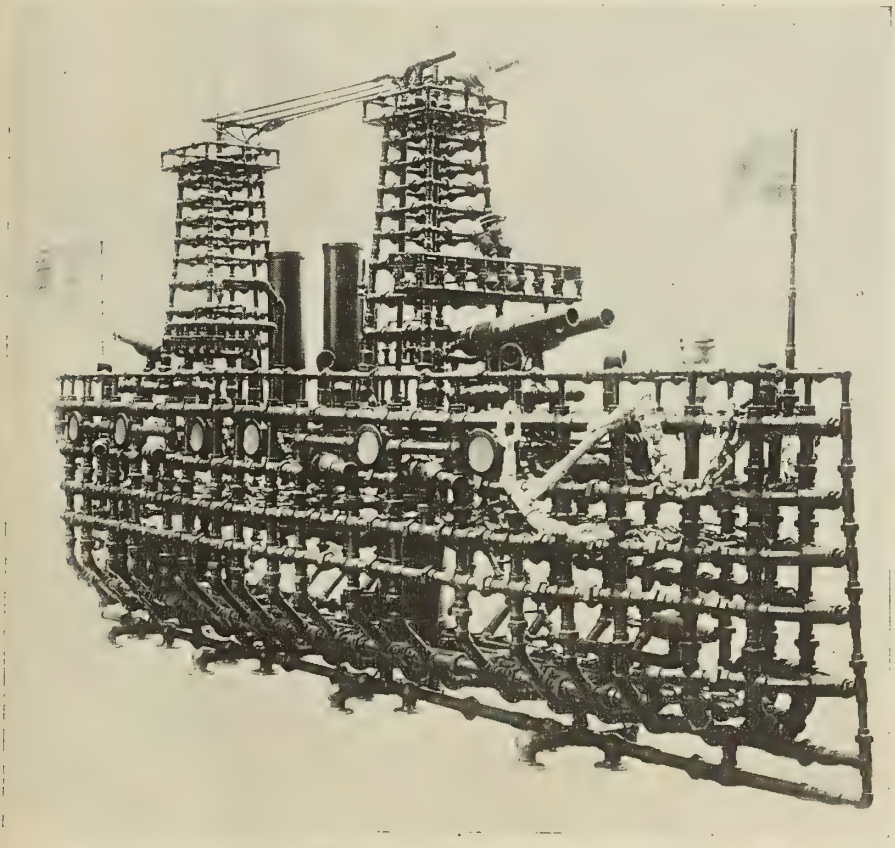
Doctor Eaton Heads National Service Section on Shipping Board

Dr. Charles A. Eaton, D.D., pastor of the Madison Avenue Baptist Church, New York city, has been appointed head of the National Service Section of the United States Shipping Board Emergency Fleet Corporation. With a staff of assistants, Dr. Eaton will visit the shipyards throughout the country for the purpose of arousing the patriotism and loyalty of shipyard workers and developing widespread adoption of thrift and industry among the shipbuilders and their families.

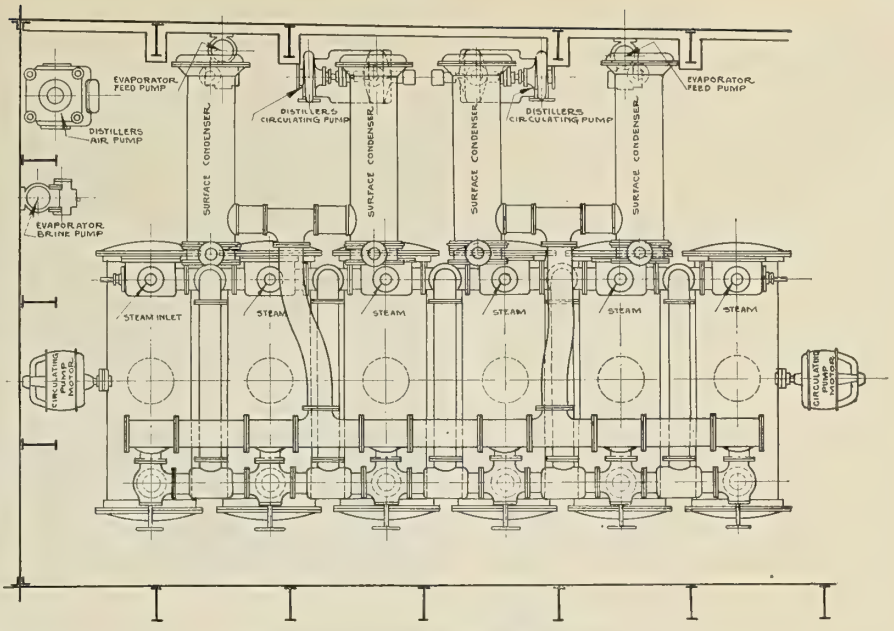
Model of U. S. S. New York Made of Crane Company Products

An employee of the Crane Company (Chicago) in the works of the company's Bridgeport division has made an ingenious model of the superdreadnaught *New York*, from Crane Company products—fittings, valves, specialties, etc. The over-all dimensions of the model are: Length, 186 inches; breadth, 34 inches; molded depth, 42 inches; total height from keel to top-mast, 102 inches. Its net weight is 3,308 pounds.

Six thousand six hundred and sixty-nine separate pieces enter into the construction of this model. It is complete to the smallest detail, and the ordinary working parts of a battleship are movable. A row of colored electric lights run from bow to stern over the mast tops, and, when in action, the model makes an interesting exhibition.



Crane Fittings Joined Together to Form Model of U. S. S. *New York*



New Modification of Lillie Evaporator

Unusual Design for Distilling Sea Water

Those who have to deal with the distilling of sea or other water, or with evaporation problems of almost any kind, will be interested in this design of Lillie Evaporator now being built by the Wheeler Condenser and Engineering Company, of Carteret, N. J. It is a modification of a regular Lillie sextuple effect sea water distilling apparatus. Two of these now under construction are to be operated by steam up to 60 pounds per square inch gage pressure, or at any lower pressure.

The point that will catch the veteran's eye is the employment of four condensers, side by side, as distinctly shown in the illustration.

This unusual arrangement of condensers permits seven different combinations of operation, as follows:

(1) It may be operated as one single effect or more single effects;

(2) It may be operated as one or more double effects, with vapors reversible in each;

(3) It is possible to operate it as a triple effect, or as two triple effects, with vapors reversible in each;

(4) It is impossible, of course, to operate it as two quadruple effects, but every effect may be utilized by grouping as one quadruple effect and one double effect, in both of which the vapors are reversible;

(5) It may be operated as one vapor reversible quadruple effect, with both end effects or either end pair of the section cut out;

(6) With one effect at either end cut out, it may be operated as a vapor reversible quintuple effect;

(7) Lastly, it may be operated as a vapor reversible sextuple effect.

It is evident that should a mishap occur at either end, in the middle, or anywhere else, there is little danger that this evaporator will be put out of commission entirely.

Concrete Ships to Be a Part of Government Shipbuilding Program

Plans and specifications for a standard type of reinforced concrete ship, of approximately 3,500 tons deadweight cargo-carrying capacity, are being made by the Department of Concrete Ship Construction of the Shipping Board. Contracts for several reinforced concrete vessels have already been let, the first to the Liberty Shipbuilding Company, Boston, and two others to the Fougner American Steel Concrete Shipbuilding Company, New York, and the Ferro Concrete Shipbuilding Corporation, New York. The number of ships called for in these contracts is dependent upon the success attained in the first vessels built.

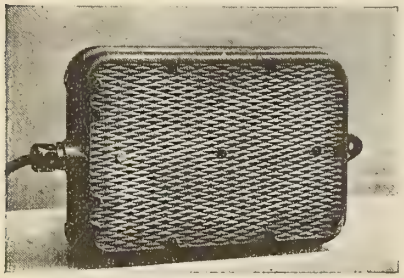
The present program of the Board, involving five vessels of different designs are essentially an experiment and upon their success or failure will depend the future of the Government's concrete ship construction. The Department of Concrete Ship Construction is also conducting a number of tests under the direction of the Bureau of Standards and the Shipping Board is co-operating with the United States Steamship Inspection Service and Lloyd's Register of Shipping. It is expected that the question of concrete barges for harbor and inland waterway service will be taken up by the various governmental bureaus concerned with that work.

The Department of Concrete Ship Construction is under the direction of James O. Hayworth, head of the Division of Wooden Shipbuilding of the United States Shipping Board Emergency Fleet Corporation, with Rudolph J. Wig, of the United States Bureau of Standards, as chief engineer. Lewis J. Ferguson is assistant chief engineer, Robert W. Boyd, of New York, consulting concrete engineer, and W. A. Slater, of the University of Illinois, concrete engineer.

The preliminary work of this department is being rushed so that definite results will be at hand early in the summer. If the experimental work proves satisfactory there will then be an opportunity for quantity production of concrete vessels during the summer.

No More Cold Feet for Ship Lookouts or Shipyard Watchmen

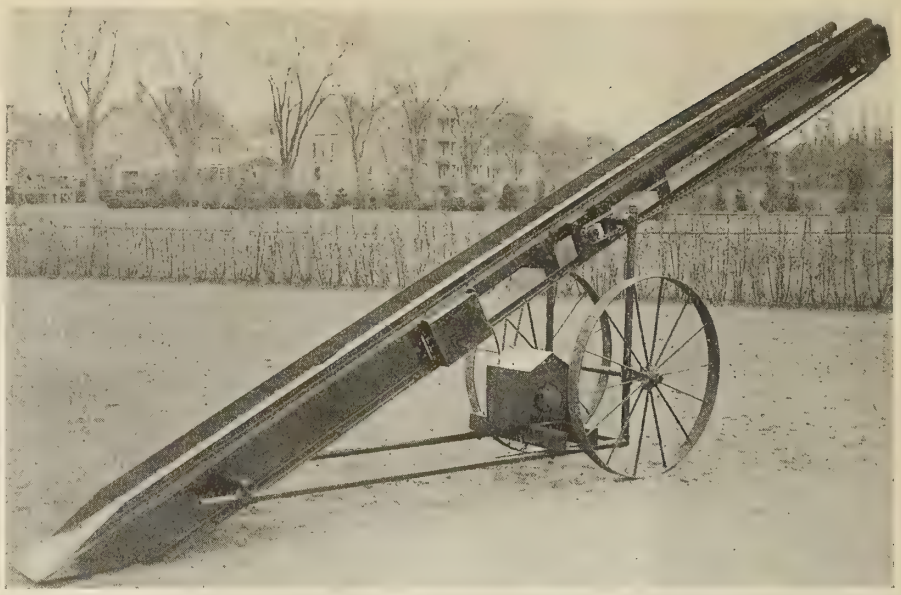
To minimize the discomfort of long standing outdoors in severe weather, an electrically heated foot-warmer has just been placed upon the market by the Westinghouse Electric and Manufacturing Company, of East Pittsburg, Pa. While designed primarily for lookouts



Electric Foot Warmer

stationed in the bow and crow's-nest of vessels, the device is applicable to the use of watchmen, sentries, doormen, traffic policemen and others whose work requires them to be out of doors continuously, with little chance for exercise. It has been found that if the rest of the body is adequately clothed, a foot-warmer will ensure comfort at any temperature.

The device consists of a casting 14 inches by 20 inches by 25 inches, with diamond-tread top. This is of cast iron, or of aluminum where non-magnetic qualities are desired, as in ship service. Against the under surface of this the heater element is clamped. The heater is a slotted ribbon clamped between two plates of built-up mica, so arranged as to give uniform distribution of heat. A sheet-steel plate, fastened by screws and sealed with high-melting gum, renders the entire unit waterproof. The resistance is divided into two parts, which may be connected to draw 200, 100 or 50 watts at 125 volts. A three-conductor cable seven feet long is provided. By using the lower heats in mild weather, there is no danger of causing chilblains.



Portable Belt Conveyor, Which Scoops Up Material to Be Conveyed

Portable Scoop Conveyor

A new type of portable belt conveyor, operated by electric motor or gasoline (petrol) engine, is being manufactured by the Portable Machinery Company, Inc., of Passaic, N. J. The machine is known as a scoop conveyor, because the conveying belt receives its material through a scoop which can be pushed or completely buried into the material to be conveyed.

The object of the scoop conveyor is to provide a portable machine that can be readily handled by one man for the purpose of loading and unloading and stacking and reclaiming loose materials, such as coal, coke, ashes, crushed stone, sand, gravel, etc. The manufacturers claim that it will also handle sacks, packages, boxes and various manufactured products, and that one man and the scoop conveyor will handle loose materials at the rate of one ton in one and one-half minutes.

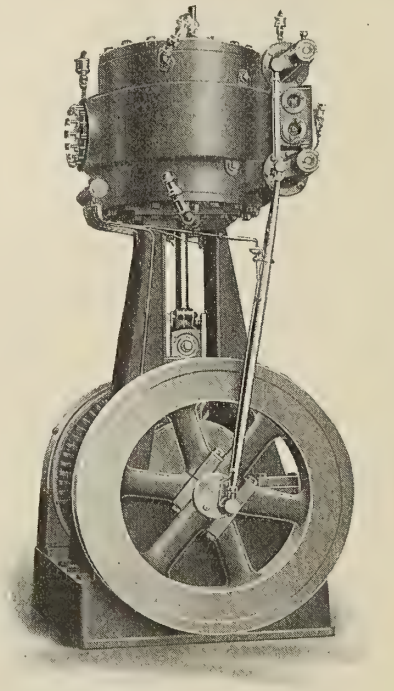
Keeping cars and trucks moving and cutting cost of hand shoveling is a necessity under present-day operating conditions, and a large number of well-known manufacturing concerns are already using anywhere from one to ten of these machines for this purpose.

Wheeler Vertical Rotative Dry Vacuum Pump

This vertical type of dry vacuum pump manufactured by the Wheeler Condenser and Engineering Company of Carteret, N. J., is in demand by ship and stationary plant builders who are anxious to save as much space as possible, and who at the same time have their eyes open to economy.

The pump shown was recently shipped by the manufacturers for installation in an American navy vessel. Another is in course of completion and will soon be shipped.

Where much condensing is to be done and where high vacuum is to be maintained, it is generally best to install separate condensate and air pumps. Thus a motor or turbine-driven centrifugal hot well pump can easily take care of the condensate while this Wheeler dry vacuum air pump withdraws the air.



Wheeler Vertical Dry Vacuum Pump

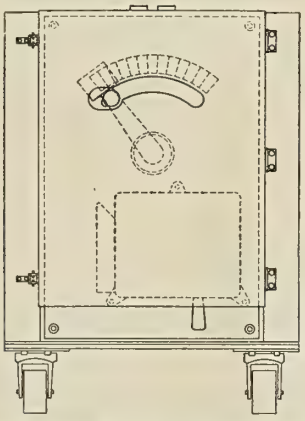
As the photograph distinctly shows, the inlet valves of this pump are of the semi-rotative type, which are so manipulated by the valve gear as to draw air from the condenser during its full stroke. Clearance difficulties are eliminated in this design of valve gear by providing ports which register with an

equalizing passage. The discharge valves are of the poppet type and are easily accessible. In fact, all parts are easily accessible, a point that is of great value in high-vacuum pumping machinery. Valve arrangement is such as to insure perfect drainage at all times.

A motor-driven dry vacuum pump has numerous other advantages over direct steam drive, among which are: ease of installation, less attention is required, no steam pipe radiation losses, and improvement of plant load factor. A few years ago it was argued that motor drive was poor practice because of the long train of elements through which power must pass before reaching the motor—the engine, generator, transmission lines, switchboard, etc.—but to-day shut-down troubles have practically vanished and authorities are strongly recommending motor-driven auxiliaries such as this dry vacuum pump.

Portable Outlet Panels for Electric Welding Service

For an electric welding outfit to be of its maximum service, it must be so arranged that it can be taken to the work, no matter where that may be located. One solution of the problem would, of course, be to locate a panel outlet of a suitable type wherever it is anticipated that electric welding might be desired. However, this is rather an



Portable Outlet Panel to Control Current for Electric Welding

expensive proposition, and many electrical engineers would prefer to accomplish the same result in a simpler manner. A recently developed portable outlet panel manufactured by the Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa., takes care of this situation with a minimum of expense and with all the simplicity of the familiar distributing system for storage battery charging.

Two types of portable outlet panels are furnished, both being mounted on light trucks. They consist of a control panel mounting a handle trip railway type circuit breaker having overload release with magnetic blowout, and a 13-point face plate connected to a resistor mounted in the rear of the panel. The face of the panel is protected by a metal cover through which the handles of the rheostat and circuit-breaker project. The resistor is made up of grids and is protected by a cage of expanded metal. Type E panel is intended for metal electrode welding, only having a capacity of from 80 to 170 amperes. With this outfit one metal electrode holder and one shield are supplied. For a wider range of work a Type F panel should be used. This will handle metal electrode work from 80 to 160 amperes, and light graphite electrode work up to 300 amperes. The outfit includes one metal electrode holder, one graphite electrode holder and one mask.

Marine Terminal Improvements

The Port Authorities of Adelaide, N. S. W., Australia, are planning to build four 1,000-foot piers, in addition to making further improvements.

The British Dominions Royal Commission, London, England, is planning vast improvements at South African ports. It is planned to spend over $13,000,000 at Durban and $15,000,000 at Capetown. Less extensive improvements are planned for other African ports.

The Oregon-Washington Railway & Navigation Company, S. Murray, Portland, Ore., chief engineer, has drawn plans for a $200,000 wharf at the foot of Hanford street.

The Board of Public Works, Beaumont, Tex., will receive bids for building several large wharves.

The State Board of Harbor Commissioners, San Francisco, Cal., will soon receive bids for building a 108 by 200 foot addition to pier 21.

The Dominion Coal Company, St. John, N. B., has let the contract to rebuild Robertson's Upper Wharf to D. C. Clark, West St. John ,

New Naval Patrol Boats to Be Built in Record Time at Ford Automobile Factory

A new type of naval patrol boat, said to possess many of the advantages of the regular destroyers, but of smaller size, has been designed by the Navy Department in the short interval of ten days, and a contract for the construction of a large number of these vessels was given to Henry Ford, the automobile builder of Detroit, on January 17. Twenty days later the keel of the first of these boats was laid, and construction of the fleet is being rapidly pushed forward at the Fort plant.

The design of the new boats was carried out in the Division of Design, Bureau of Construction and Repair, under the direction of Naval Constructor Stocker, U. S. N., and in the Bureau of Steam Engineering, under the direction of Rear Admiral C. W. Dyson, U. S. N. A model was made and tested in the experimental tank at the Washington Navy Yard.

Mr. Ford's offer to build naval vessels at his plant was made in a letter dated December 22, 1917. On December 31, after a visit to Washington and consultation with the chiefs of the Bureau of Construction and Repair and the Bureau of Steam Engineering, Mr. Ford and his staff were given preliminary plans and specifications of the boats to be built, and on January 12 complete plans were delivered to representatives of the Ford Company. On January 15 Mr. Ford telegraphed his proposition to the Navy Department, and on the 17th the Department telegraphed the award to the Ford Company for building a large number of the boats. On February 17 the keel of the first boat was laid.

PERSONAL

Capt. C. S. Bookwalter, formerly agent of the United States Shipping Board Emergency Fleet Corporation, in charge of the New York district, has been appointed assistant to Rear-Admiral F. T. Bowles, in charge of the Government shipyards, with headquarters in Philadelphia.

H. L. Joyce, manager of the marine department of the Central Railroad of New Jersey, has been appointed by the Mayor of New York city manager of the National Defense Committee.

George H. Shaw, for the past five years sanitary engineer of the United States Department of Agriculture, has been appointed sanitary engineer with the United States Shipping Board and Emergency Fleet Corporation.

Joseph N. Pew, Jr., has been elected president of the Sun Shipbuilding Company, Chester, Pa., to succeed his brother, J. Howard Pew, who becomes vice-president of the company.

Stephen H. Cossey, Tottenville, N. Y., an expert in wooden ship construction, has been appointed traveling inspector by the United States Shipping Board Emergency Fleet Corporation, to speed up wooden ship construction.

W. J. Sergent, superintending engineer of the Allen Line and Canadian Pacific Ocean Services, has retired from active service after eighteen years' association with the company. Mr. Sergent continues as an official of the company in a consulting capacity.

Kenneth Mackenzie, M. Eng., chief assistant to the superintending engineer of the Canadian Pacific Ocean Services, Ltd., has been appointed chief superintending engineer of all the company's fleets, with headquarters in Liverpool, vice W. J. Sergent, retired.

W. H. Pleasants, of New York, president of the Ocean Steamship Company, has been appointed manager of the marine section of the Government Railroad Administration, and will have charge of the Coastwise and Great Lakes Steamship Lines operated by the railroads.

David H. E. Jones, head of the old shipping house of James W. Elwell & Company, New York, agents of the Fabre Line, has been decorated by the French Republic with the cross of the Legion of Honor.

L. A. Baier, formerly chief, scientific department, Seattle Construction & Dry Dock Company, Seattle, Wash., has removed to 2507 Madison avenue, Baltimore, Md.

F. E. Pratt, who has been connected with engineering matters in the marine field for many years, is now connected with the sales department of the Steam Motors Company, of Springfield, with offices at 30 Church street, New York.

OBITUARY

Harvey C. Beeson, publisher of Beeson's Marine Directory, Chicago, died on February 13.

Adam Cook, head of the firm of Adam Cook's Sons, dealers in lubricating oils, died recently in New York, aged 52.

Henry B. Newhall, founder of the Newhall Chain, Forge & Iron Company of New York, died recently at his home in Littleton, N. H., aged 74.

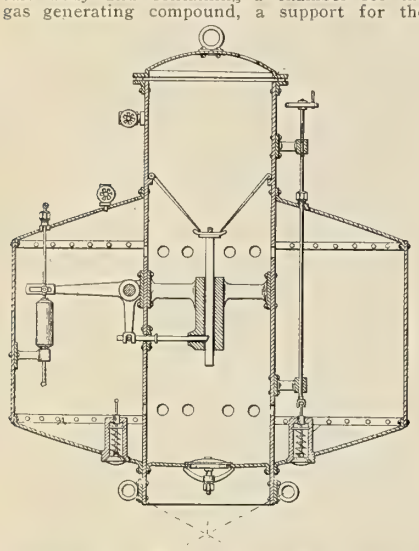
SELECTED MARINE PATENTS

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents, compiled by Delbert H. Decker, Esq., registered patent attorney, Millerton, N. Y.

1,240,180. MEANS FOR RAISING SUNKEN VESSELS. RAFAEL DE ARAZOZA, OF HABANA, CUBA.

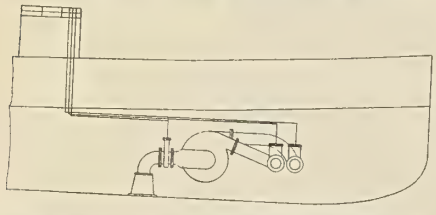
Claim 1.—In a float, a body, a cylindrical gas generator concentrically arranged within said body and containing a chamber for the gas generating compound, a support for the



collapsible bottom of said chamber, a latch or trigger normally maintaining said support in its raised position, means for operating said trigger for releasing the support and means for regulating the air and water supply and exhaust. Two claims.

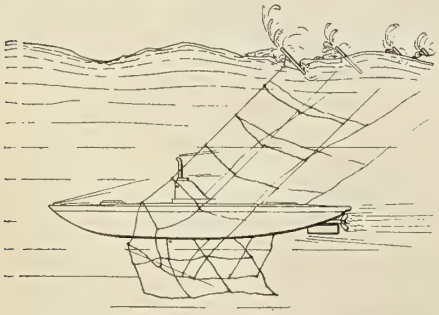
1,240,932. DREDGER. WM. BROWN AND WALTER BROWN, OF RENFREW, SCOTLAND.

Claim.—In a dredger, in combination, nozzles located one at each side of the bow, a pair of pumps located adjacent to said nozzles, pipe connections leading from the discharge



side of each pump to both nozzles, water supply pipes connected to the inlets of said pumps and penetrating the bottom of the dredger hull, valves operable from the dredger bridge to control the supply and outlet pipes and to determine which nozzle will be supplied with water, and a common diaphragm for cutting off communication between either pump and said nozzles, substantially as and for the purpose set forth.

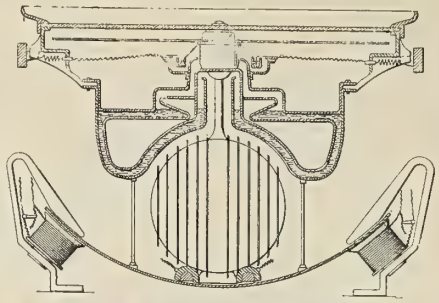
1,242,386. SUBMARINE DETECTOR. WILLIAM A. STEWART, OF EAST ORANGE, N. J.



Claim 3.—A submarine detector comprising a submerged device of considerable area, means for mooring the device sufficient to prevent drifting, and a series of floats connected to the device and inconspicuous when moored but conspicuous when the device is engaged by a moving body and the floats are towed by the device. Eight claims.

1,242,065. SHIP'S GYROSCOPIC-COMPASS SET. ELMER A. SPERRY, OF BROOKLYN, N.Y., ASSIGNOR TO SPERRY GYROSCOPE COMPANY.

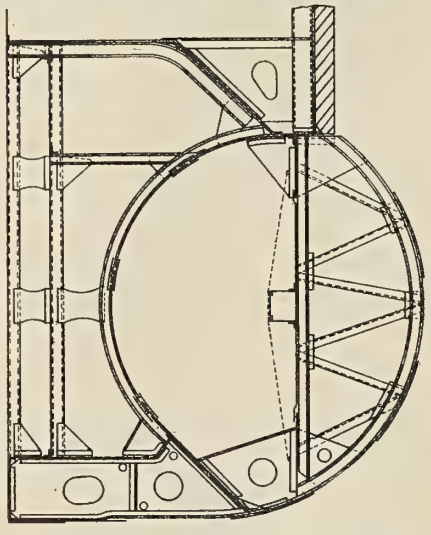
Claim 1.—In gyro navigation apparatus, a gyro wheel including an electrically driven part, a float for supporting the gyro in stable equilibrium, a central guiding member independent



of said float for confining the motion of the gyro and float, a mercury cup into which the guiding member dips, electric circuits for the apparatus including said guiding member and an insulating support for said guiding member. Thirty-four claims.

1,246,494. WARSHIP AND OTHER SEA-GOING VESSEL. THOMAS GEORGE OWENS THURSTON, OF WESTMINSTER, LONDON, ASSIGNOR TO VICKERS, LTD.

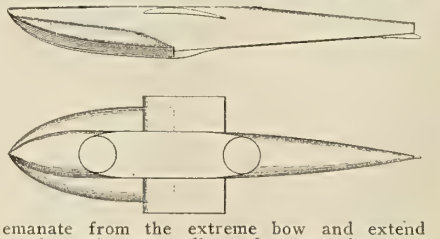
Claim 1.—A vessel having along its side a series of chambers for the purpose of protecting it from the effect of submarine explosions



by serving as resistance and expansion chambers for the explosion gases, each of the said chambers, comprising a voluminous outer compartment having an outer wall which projects beyond the usual and normal contour of the vessel, and an inner compartment of strong structural form. Ten claims.

1,246,019. FLYING-BOAT HULL. GLENN H. CURTISS, OF BUFFALO, N. Y., ASSIGNOR TO CURTISS AEROPLANE AND MOTOR CORPORATION.

Claim 4.—A flying boat including a hull having its bottom area laterally increased by heavily overhung fin excrescences which



emanate from the extreme bow and extend continuously outwardly and rearwardly to a point of maximum beam and hence rearwardly substantially in parallelism for termination at a point in the transverse vertical plane of a line projected vertically through the center of gravity. Six claims.

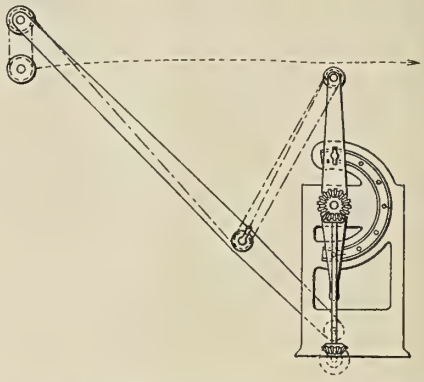
1,239,999. EMPTYING AND FILLING THE BALLAST-TANKS OF SUBMARINE VESSELS. HAROLD EDGAR YARROW, OF SCOTSTOUN, GLASGOW, SCOTLAND.

Claim 1.—In a submarine vessel, the combination, with the valves of a group of ballast tanks; of a controlling member which, by its position, determines the setting of all of said valves, at whatever parts of the vessel they may be placed; and non-rigid means, adapted to open and close the valves, connecting said controlling member with each valve. Ten claims.

British patents compiled by G. F. Redfern & Co., chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 10 Gray's Inn place, W. C., London.

108,550. "IMPROVEMENTS RELATING TO SHIPS' DAVITS." J. STORIE, EDINBURGH.

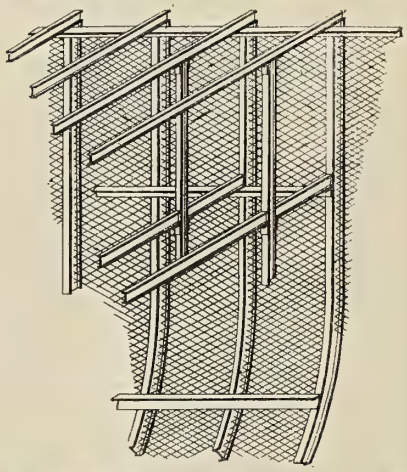
This invention relates particularly to ships' davits which are luffed or tilted outboard in a vertical plane. The object is to provide improved methods of compensating for the lowering of the davit head, and also to compensate



for the vessel taking a list. In this invention a simple means is provided of changing the path taken by the boat, so that the boat's course may be set with a considerable downward or upward inclination to its former course, and the boat can be moved outboard in a horizontal line even when the ship has a heavy list, no increase in the driving or controlling power being required.

110,423. "IMPROVEMENTS IN AND RELATING TO THE CONSTRUCTION OF OCEAN-GOING STEAMSHIPS AND OTHER LIKE VESSELS." J. C. GRANT, OF LONDON, S. W.

The invention consists in constructing an ocean-going steamship or other ocean-going vessel by forming the framework in the usual way as for a steel or iron plated vessel of iron or



steel frames and in forming the sides and bottom of the vessel supported by these frames of ferro-concrete or ferro-cement, the whole forming a monolithic structure roughly in the form of a half cylinder forming a monolithic decked vessel having its own means of propulsion. The invention further consists in constructing the vessel with frames of double T-shaped section arranged at a distance from one to two feet apart, connecting such frames by longitudinal rods passing through apertures in the frames, placing suitable molds in contact with the frames on the inside and the outside and filling in with concrete or cement to form the walls of the vessel.